YEAR 1909

Ten storms were found to have occurred in 1909. Tracks for these storms are presented in Fig. 1.

Storm 1, 1909 (Jun. 25-30), T. S.

The following information was found in relation to this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Jun. 25, Key West, S.S.W. f. 3, 29.90; ship near 24.7 N., 83 W., S.S.W. f. 4, 29.90; ship near 20 N., 83 W., S.W. f. 3, 29.88; ship near 25 N., 84 W., N.N.W. f. 2, pressure could not be read, rain; ship near 25 N., 85 W., N.E. f. 4, 30.06 (too high); ship near 23.3 N., 87 W., N.W. f. 3, 29.91. Jun. 26, ship near 23 N., 86 W., W.S.W. f.2, 29.94; ship near 24.7 N., 83 W., S. f. 4, 29.96; ship near 26.8 N., 90 W., S.W. f. 8, 29.86 (position appears to be wrong); Port Eads, N.E. f. 3, 29.90. Jun. 27, Port Eads, S.E. f. 5, 29.91; ship near 27 N., 87 W., S. f. 5, pressure could not be read, rain; ship near 27.7 N., 86 W., S.E. f. 6, 29.97; ship near 26.8 N., 91 W., E. f. 3, 29.86; low placed 25.5 N., 91 W.. Jun. 28, ship near 25 N., 90 W., S.S.W. f. 5, 29.88; Port Eads, S.E. f. 3, 29.91, showers; ship near 21 N,. 95 W., S.W. f. 1, 29.91; Galveston, N. f. 3, 29.96; Tampico, calm, 29.82; Brownsville, E. no speed, 29.94. Jun. 29, Galveston, N. f. 6, 29.83; Corpus Christi, N.W. f. 3, 29.82; ship near 28 N., 91 W., E.S.E. f. 3. Jun. 30, Brownsville, W. no speed, barometer could not be clearly read but likely to be 29.72; Corpus Christi, N. f. 6, 29.69; Galveston, N.E. f. 4, 29.86; center placed just N.E. of Brownsville, but to the E.S.E. and quite close to Corpus Christi appears to be a much better location (Historical Weather Maps, Jun. 1909). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches. 2) The only storm of the month (according to the New Orleans forecast district) appeared off the mouth of the Rio Grande River on Jun. 30, and storm warnings were ordered for the Texas coast. The storm moved westward into Mexico and reports indicate that it was the most severe that have visited the section near the mouth of the Rio Grande in several years. I.M. Cline, District Forecaster (Monthly Weather Review, Jun. 1909) Author's note: The storm center made landfall on the Lower Texas coast and not on the Mexican coast. 3) Maximum wind velocities associated with the storm were: Corpus Christi, N.E. 48 mph on Jun. 30; Galveston, N.E. 40 mph on Jun. 29 (Monthly Weather Review, Jun. 1909. 4) Minimum pressure at Corpus Christi was 29.65 inches (Weather Bureau, 1911). Author's note: Apparently this value was not corrected to sea level. 5) Brownsville, Tx., Jun. 30. Tarpon Beach, a summer resort at the end of Padre Island, is isolated and inundated and the fate of the inhabitants is problematic. A storm of extraordinary severity raged here today with water 5-ft deep still rising when the last wire was lost (The Tampa Morning Tribune, Jul. 1, 1909, p.1, col.3). 6) Storm of Jun. 30, 1909. Lower Texas coast. Minor (Dunn and Miller, 1960). 7) A storm was first observed near 25 N., 84 W. on Jun. 25, 1909 and lasted 5 days; it was last observed near 27 N., 98 W. (Mitchell, 1924). Author's note: Tracks for this storm in Tannehill (1993) and in Neumann et al. (1993) were found to be quite similar to the corresponding track in Mitchell (1924).

On the basis of information contained in the above items, particularly in item 1), the author of this study introduced some modifications along the storm track shown in Neumann et al. (1993). Their 7 A.M. Jun. 25 position was kept unchanged because it was found to fit information in item 1). Author's 7 A.M. positions for the period Jun. 26-30 were estimated as follows: Jun. 26, near 26.7 degrees N., 87.0 degrees W.; Jun. 27, near 27.0 degrees N., 90.0 degrees W.; Jun. 28, near 27.0 degrees N., 92.5 degrees W.; Jun. 29, near 27.0 degrees N., 94.7 degrees W.; Jun. 30, near 27.0 degrees N., 97.0 degrees W. The difference between these positions and the corresponding ones in Neumann et al. (1993) was found to range from about 90 miles on Jun. 27 to about 45 miles on Jun. 29. With the exception of Jun. 30, author's positions were to the N. of those shown in the above publications. The author's track for Storm 1, 1909 is shown in Fig. 1.

The tropical storm status which Neumann et al. (1993) gave to this storm was supported by the maximum wind velocities of 48 mph at Corpus Christi and 40 mph at Galveston (item 3) and by the minimum pressure of 29.65 inches reported at Corpus Christi (item 4). As in Neumann et al. (1993), the author's track indicated tropical storm intensity over the period Jun. 25=-30, and

the tropical depression (dissipation) stage was introduced along the track after the storm made landfall on the Texas coast.

Storm 2, 1909 (Jun. 27- Jul. 4), T. S.

The following information was found about this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Jun. 26, no data; Jun. 27, ship or Cuban station near 21 N., 76 W., W. f. 1, 29.83; Jupiter, N. f. 2, 30.03; no other data in the storm area. Jun. 28, Jupiter, N.N.E. f. 3, 29.91; Key West, N. f. 2, 29.96; ship near 23 N., 79 W., S.S.W. f. 5, 29.80, wind maybe too high. Jun. 29, Tampa, N.N.W. f. 2, 29.77; Jupiter, S.W. f. 5, 29.88; Jacksonville, E. f. 4, 29.87; Thomasville (N.E. of Tallahassee), N.E. f. 3, 29.91. Jun. 30, Tampa, S. f.5; Thomasville, N.E. f. 3, barometer could not be clearly read but probably 29.73; Jacksonville, S.S.E. f. 4, 29.88; center placed 28.5 N., 85 W., but 30 N., 84 W. is a much better location (Historical Weather Maps, Jun,. 1909). Author's note: In this item and in item 2), wind forces (f) are on Beaufort scale and pressures are in inches. 2) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Jul. 1, Thomasville, S.E. f. 2, 29.79, rain; Montgomery, N.E. f. 2. 29.84; ship near 26 N., 86 W., W.S.W. to S.W. f. 6, 29.81; Pensacola, N.W. f. 2, 29.82. Jul. 2, Jacksonville, S. to S.S.W. f. 5, 29.81; Thomasville, N.W. f. 3, 29.79; Charleston, S.S.W. f. 3, 29.84; Atlanta, N.N.W. f. 3, 29.85; low apparently embedded in a weak trough in the westerlies over Ga. and S.C. Jul. 3, Jacksonville, W. f. 2, 29.72; Charleston, N.E. f. 4, 29.68; low apparently off Charleston. Jul. 4, ship near 29 N., 74 W., S.W. f. 7, 29.77; low apparently near 30.3 N., 74.5 W.. Jul. 5, system no longer identified (Historical Weather Maps, Jul. 1909). 3) Washington, Jun. 29. "Storm over Florida, gaining in intensity and moving northward, winds increasing in South Atlantic States. Moore" The brief message is reproduced as coming to Observer Blackman from the Weather Bureau of Washington. There was every indication yesterday that the winds at sea (off Miami) were high (The Miami Metropilis, Jun. 29, 1909, p.1, col.1). 4) One on the severest rain and wind storms in many months swept the entire area between 6 P.M. yesterday and 10 P.M. last night. The heaviest downpour was between 7 and 8 P.M., when business houses were closing for the day and many were caught downtown and forced to remain nearly 9 P.M. Although no official report has yet been made by the Weather Bureau as to the velocity of the wind, it is estimated as from 25 to 40 mph. There was considerable damage to crops, telegraph and telephone wires and small craft that happened to be caught in exposed places. In some sections of the city (Tampa) window panes were blown in and there were many uneasy residents (The Tampa Morning Tribune, Jun. 30, 1909, p.1, col.6). 5) For 6 hours Tuesday night (Jun. 29), the wind in Tampa remained at a velocity exceeding 30 mph, while at 8:30 P.M. it was blowing at a rate of 40 mph. Key West was affected by the storm before it reached Tampa. Reports from Bartow yesterday morning (Jun. 30) stated that water was standing on the streets from the rain and that Lakeland was visited in similar fashion. According to the captain of the government ship "Pickering", the winds at the keys (off Tampa) reached a very high velocity that it was probably much greater than in the city (The Tampa Morning Tribune, Jul. 1, 1909, p.5, cols. 5-6). 6) Maximum velocity at Tampa was S.W. 40 mph on Jun. 29; at Key West, it was N.W. 32 mph on Jun. 28 (Monthly Weather Review, Jun. 1909). 7) Minimum pressure at Tampa (apparently without correction to sea level) was 29.72 inches (Weather Bureau, 1911). 8) Track for the storm starting near 25 N., 79 W. in the evening of Jun. 27 and ending near 31 N., 86 W. in the evening of Jun. 30 (Monthly Weather Review, Jun. 1909). Author's note: This track was continued in Monthly Weather Review, Jul. 1909, as follows: morning of Jul. 1, near 31 N., 84.5 W.; morning of Jul. 2, near 31.5 N., 83 W.; morning of Jul. 3, just S.S.E. of Charleston; morning of Jul. 4, off the coast between Charleston and Wilmington, after having been inland (near the S.C.-N.C. border) in the evening of Jul. 3. 9) A storm was first observed near 22 N., 73 W. on Jun. 26, 1909 and lasted 5 days; it was last observed near 31 N., 89 W. (Mitchell, 1924). Author's note: The track in Tannehill (1938) was found to be quite similar to the one in Mitchell (1924); the track in Neaumann et al. (1993) was also similar to the one in the Mitchell (1924).

Primarily on the basis of information in items 1) and 2), the author of this study introduced a number of modifications along the track in Neumann et al. (1993) and extended his storm track

for Storm 2 , 1909 to July 4. The author's track was started on Jun. 27 or one day later than in Neumann et al. (1993); the author's 7 A.M. Jun. 27 position was estimated near 22.0 degrees N., 76.0 degrees W. and was found to be about 180 miles to the S.S.E. of the position for that day in the above publication. Author's 7 A.M. positions for the period Jun. 28- Jul. 4 were estimated as follows: Jun. 28, near 25.0 degrees N., 79.3 degrees W; Jun. 29, near 28.0 degrees N., 81.7 degrees W.; Jun. 30, near 30.0 degrees N., 84.0 degrees W.; Jul. 1, near 31.0 degrees N., 84.7 degrees W.; Jul. 2, near 32.0 degrees N., 83.5 degrees W.; Jul. 3, near 32.3 degrees N., 79.7 degrees W.; Jul. 4, near 30.3 degrees N., 74.5 degrees W. For the period Jun. 28- Jul. 1, the difference between 7 A.M. positions along the author's track and corresponding ones in Neumann et al. (1993) ranged from about 270 miles on Jul. 1 to about 75 miles on Jun. 29-30. The author's track for Storm 2, 1909 id displayed in Fig. 1.

The tropical storm status which Neumann et al. (1993) gave to this storm was found to be supported by the maximum wind velocity of 40 mph reported to have occurred at Tampa (items 5 ad 6). Tropical storm intensity was shown along the author's track for the period Jun. 27-30 and the tropical depression (dissipation) stage was introduced on Jul. 1 and kept until Jul. 4. Some slight intensification appeared to have occurred after the system moved back over Atlantic waters; this was suggested by a ship observation on Jul. 4 (item 2) but, as there was no evidence of reintensification to tropical storm status and the system could not be identified on Jul. 5 (item 2), the maintenance of the tropical depression (dissipation) stage was fully justified.

Storm 3, 1909 (Jul. 17-22), H.

The following information was found about this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Jul. 13-17, no indication of a closed cyclonic circulation was shown by the Caribbean data which were rather sparse. Jul. 17, Kingston, S.E. f. 4, 29.91; Havana, E. f. 3, 30.01; ship near 12 N., 78 W., S. f. 3, 29.86; ship near 21 N., 84 W., E. f. 2. Jul. 18, ship near 23 N., 86 W., N.E. f. 4, 29.83 (probably too low); ship near 22 N., 87 W., N.E. to N.N.E. f. 2, 29.97; Havana, S.E. f. 4, 29.97; ship near 21 N., 82 W., S. f. 6, 29.88; low placed 18.5 N., 85.5 W. (too far S. and W.). Jul. 19, ship near 26 N., 86 W., S.E. 10, 29.71, rain; ship off Cape San Antonio, S. f. 4, 29.94; center placed 25 N., 86.5 W., probably a bit E. Jul. 20, Port Eads, E. f. 4, 29.91; ship near 26 N., 87 W.m S. f. 6, 29.94; center placed 25.5 N., 90 W., probably too far S. and a bit E. Jul. 21, Galveston, N. f. 5, 29.76; Corpus Christi, N.W. f. 3, 29.92; ship near 27 N., 90 W., S. f. 7, 30.09 (maybe too high), lightning; center placed 28 N., 94 W. Jul. 22, San Antonio, S. f. 5, 29.84; center inferred not far from 30 N., 100 W., with a station to the S.W. of that location having calm, 29.84 (Historical Weather Maps, Jul. 1909). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches. 2) Belen College Observatory, Jul. 17, 5 P.M. This morning's observations showed a cyclonic perturbation in its formative stage to the S.W. of Jamaica and S.E. of Grand Cayman. According to "ordinary laws", the probable course of the depression will be W.N.W., passing to the Gulf (of Mexico) through the vicinity of the Yucatan Channel (Diario de la Marina, Havana, Jul. 18, 1909, morning edition, p.5, col.1). 3) At 2 P.M. yesterday Luis G. Carbonell, Chief of the National Meteorological Observatory informed the following via telephone: "There is a cyclonic perturbation to the W. of Jamaica. It appears to be moving towards the Yucatan Channel. So far, it is of weak intensity" (Diario de la Marina, Havana, Jul. 18, 1909, morning edition, p.5, col.1). 4) Belen College Observatory. Last Saturday , Jul. 17 at 5 P.M. we published in the local press that there were some indications of a cyclonic perturbation to the S.W. of Jamaica and S.E. of Grand Cayman, adding at 2 P.M. Sunday (Jul. 18) that the principal center was then to the W. one quarter to the S.W. of Havana, passing through the extreme western Cuba into the Gulf of Mexico. As a confirmation we has just received at 1:45 P.M. (Jul. 21) the following cablegram from Mr. Moore, Chief of the Weather Bureau of Washington: "It has been advised that the perturbation observed over the Caribbean Sea on Saturday (Jul. 17) is now approaching the Texas coast near Galveston; the storm is very severe and it will probably pass inland to the W. of Galveston". M. Gutierrez-Lanza, S.J., Assistant Director (Diario de la Marina, Havana, Jul. 22, 1909, morning edition, p. 4, col.5). Author's note: A similar telegram from the Weather Bureau

was also received by the National Meteorological Observatory (of Cuba) and published in the same issue of Diario de la Marina. 5) Batabano, Jul. 19, 8:30 A.M. It has been raining heavily and persistently over 2 days, with high winds and rough seas. Several vessels have sunk but there were no casualties. Water is one-yard deep in some streets (Diario de la Marina, Havana, Jul. 19, 1909, evening edition, p.4, col.6). Author's note: Batabano is located on the southern coast of Havana province. 6) Washington, Jul. 16. Conditions along the Gulf coast remain unsettled owing to the presence over the Gulf of Mexico of a disturbance that has moved there from the Caribbean Sea (The New York Times, Jul. 20, 1909, p.12, col.7). 7) Washington, Jul. 21. The storm from the Gulf has passed inland, the vortex apparently passing near Galveston about noon Wednesday (Jul. 21). It is probable that the storm will mitigate rapidly as it passes. Daily advices regarding the presence of this storm over the Caribbean Sea and the Gulf of Mexico have been furnished shipping interests during the last 5 days (The New York Times, Jul. 22, 1909, p.13, col.7). Author's note: The above statement was probably issued in the evening of Jul. 21. 8) From a report by W.F. Berg, master of the steamship "Paraguay" on voyage from Sabine Pass, Tx. to Marcus Hook, Pa.: We left Sabine Pass on Jul. 18 at 6 P.M.. By 8 P.M. (Jul. 19) the wind had increased in force to a strong gale (from the northward). Our lat. at noon was 28 27 N., long. 91 16 W.; at midnight (Jul. 19-20) the skies had become overcast. At 8 A.N. Jul. 20 the wind was still from the northward, blowing a strong gale, with frequent heavy squalls, heavy rain and heavy cross sea. At 10 A.M. the wind died away altogether. At 11 A.M. the barometer read 29.10 inches (lowest) and the wind sprang up from the southward blowing full hurricane force, accompanied by very heavy rain, lasting until nearly 4 P.M. without a perceptible break. About 4 P.M. the weather became squally, the squalls gradually becoming less violent until at midnight we were able to proceed on our course, the wind at that time being a strong S.E. breeze with a clear sky and rough seas (Monthly Weather Review, Jul. 1909). Author's note: A series of barometer readings was also included, showing that the pressure dropped from 30.08 inches at 4 P.M. Jul. 19 to 29.10 inches at 10 A.M. Jul. 20, then rising to 29.13 at noon and to 29.90 at 8:50 P.M. The readings were taken from the aneroid barometer which was compared with the standard barometer at Philadelphia Pa.and was found to read 0.02 inches too high. Therefore, the lowest pressure reported by the "Paraguay" was 29.08 inches, after applying the proper correction. 9) The steamer "El Siglo" met with the storm on Monday (Jul. 19) and had to fight her way for 12 hours. The storm began with a succession of heavy showers, first from the E. and then from the S.E. and it finally resolved itself into a whirling gale which made the ship danced until it scudded eastward (The New York Times, Jul. 24, 1909, p.14, col.4). 10) The lowest corrected reading on land, 29.00 inches, was observed at Bay City, Tx. at 2:30 P.M. Jul. 21. The maximum time at which the center of the storm appears to have passed a given point has been estimated at one hour, this would make the diameter of the center 10 miles, but it is probable that the diameter increased rapidly over land and was much smaller over the Gulf... At Angleton, high northerly winds prevailed during the forenoon of Jul. 21. It shifted to the S.E. and S. about 12:30 P.M. and immediately attained hurricane force. There was some clearing of the sky, but only a slight lull in the wind. At Velasco, which had been a town of 600 people, apparently one-half of the town was destroyed. There was a calm of 45 minutes and for a few minutes the sun came out. The wind shifted to S. about 12:30 P.M.... At Brazoria, the wind in the morning was N.W. by N.. After 10 A.M. it increased suddenly in violence. About noon there was a lull for almost one hour; then the return wind struck fast and fierce... The center of the storm passed over El Campo, TX., where there was a lull in the wind from about 4:20 P.M. to 4:40 P.M., when the wind blew from a nearly opposite direction. (Barometer readings were lowest, 29.33 inches, at 2 P.M. and 4 P.M., with a rise to 29.45 inches at 3 P.M. All readings seem to be from 0.2 to 0.3 inch too high)... At Hattlettsville, Tx., about 3 P.M. the wind refreshed from a northerly direction , with an already cloudy sky and continued to gain in velocity. The barometer continued to fall and by 5 P.M. the storm was upon the town increasing in force until about 8:30, when the barometer ceased to fall, remaining stationary for a few minutes, and then began to rise with great rapidity. After this the wind slowly abated and by 9:30 P.M. had shifted, by way of W. and S., to the S.E., where it died away (Monthly Weather Review, Jul. 1909). Author's note: Information for Velasco and Bay City was also published in Tannehill (1938) and a short summary of the storm was included in Weather

Bureau (1911). 11) At Galveston at 10:25 A.M. Jul. 21 the wind was from the E. and at 10:50 A.M. attained a velocity of 68 mph for 5 minutes. During this high velocity a gust of one-minute duration occurred at a rate of 78 mph. The lowest pressure at Galveston was 29.56 inches at 10:05 A.M. At 7 A.M. the barometer reading was 29.76 inches and recovered to about the same value (29.75 inches) at 2 P.M. (Monthly Weather Review, Jul. 1909). Author's note: Weather Bureau (1911) gave the minimum pressure at Galveston as 29.53 inches, but the difference can be accounted for by the fact that this latter value was not corrected to sea level. 12) Table shown an estimated pressure of 958 millibars (28.29 inches) when the storm center made landfall on the Texas coast (Simpson and Riehl, 1981). Author's mote: The table was taken from Hurricane Experience Level of Coastal County Populations -Texas to Maine, MWS Southern Region Tech. Rept. 12, 1975 by P.J. Hebert and G. Taylor. 13) Galveston, Jul. 21. Fortified behind her seventeen-foot sea wall, and elevated to a point about the danger line, Galveston today passed safely through a hurricane that resembled the disastrous storm of 1900 (The New York Times, Jul. 22, 1909, p.2, col.4). 14) Storm of Jul. 21, 1909. Velasco, Tx., Major, 41 killed (Dunn and Miller, 1960). 15) Map showing a track for the storm as follows: Morning of Jul. 18, just S.W. of extreme western Cuba; morning of Jul. 19, near 23.5 N., 88 W.; morning of Jul. 20, near 26.5 N., 91 W.; morning of Jul. 21, near 27.5 N., 94.5 W.; evening of Jul. 21, near 28.5 N., 98 W.; morning of Jul. 22, near 29.5 N., 99.5 W. (Monthly Weather Review, Jul. 1909). 15) A storm was first observed near 12 N., 60 W. on Jul. 13, 1909 and lasted 9 days; it was last observed near 30 N., 100 W. (Mitchell, 1924). Author's note: Tracks for this storm in Tannehill (1938) and Neumann et al. (1993) were found to be similar to the corresponding track in Mitchell (1924).

On the basis of information in the above items, the author of this study introduced a number of modifications along the track for Storm 3, 1909 in Neumann et al. (1993). As no indication of a closed cyclonic circulation was revealed by the Caribbean data over the period Jul. 13-16 (item 1), the author decided to start his track on Jul. 17 instead of on Jul. 13 as in the above publication. The author's 7 A.M. Jul. 17 position was based on information in items 1) through 3) and was estimated near 17.0 degrees N., 80.0 degrees W.; this position was found to be about 150 miles to the S.S.E. of the corresponding one in Neumann et al. (1993). The author's 7 A.M. Jul. 18 position was based on information in items 1) and 4) and was estimated near 21.0 degrees N., 84.0 degrees W.; this position was about 90 miles to the S.E. of the corresponding one in the above publication. The author's 7 A.M. Jul. 19 position was based on information in item 1) and was estimated near 25.0 degrees N., 87.5 degrees W.; this position was about 50 miles to the N.E. of the corresponding position in the above publication. The author's 7 A.M. Jul. 20 position was based on information in items 1) and 8) and was estimated near 27.0 degrees N., 90.5 degrees W.; this position was about 40 miles to the N.N.E. of the corresponding one in the above publication. 7 A.M. positions for Jul. 21 and Jul. 22 in Neumann et al. (1993) were supported by an analysis of information for those days in items 1), 10) and 11) and, therefore, were kept unchanged. The author's track for Storm 3, 1909 is shown in Fig. 1.

The hurricane status that Neumann et al. (1993) gave to this storm was found to agree with information contained in several of the 16 items above and, as a matter of fact, specific information in items 12) and 14) showed that the storm was a major hurricane. Hurricane intensity was introduced along the author's track very early on Jul. 19 on the basis of a ship report showing a S.E. force 10 wind on the Beaufort scale at 8 A.M. observation time (item 1) and suggesting a significant intensification of the storm from the previous day; such hurricane intensity was maintained until the storm had moved about 80 miles inland by late Jul. 21. Then, the storm was quickly downgraded to tropical storm status and to the depression (dissipation) stage. Tropical storm status was also shown along the author's track for the entire period Jul. 17-18.

Storm 4, 1909 (Aug. 6-10), T. S.

The following information was found in relation to this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Jul. 27, two ships near 17 N. and between 51 W. and 53 W., with E. to E.N.E. winds f. 4-5 and pressures 30.03- 30.09 inches; ship near 8 N., 48 W., W.S.W, f. 4, 30.03, drizzle; a disturbance, if any, was most likely embedded in the ITCZ. Jul.

28-29, no evidence of a closed cyclonic circulation in the few data E. of the Windward Islands. Jul. 30-31, no evidence of a closed circulation in the sparse data in the E. Caribbean Sea (Historical Weather Maps, Jul. 1909). Author's note: In this item and in item 2), wind forces (f) are on Beaufort scale and pressures are in inches. 2) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Aug. 1-4, no closed circulation could be supported by the Caribbean data which were available. Aug. 5, ship near 13 N., 71 W., S.W. f. 2, 30.09 (wrong pressure); Kingston, N. f. 1, 29.91; ship near 15 N., 77 W., E. f. 2, showers; data allowed for a possible center near 15 N., 73.5 W.but this is questionable. Aug. 6, Kingston, S.E. f. 2, 29.90; ship near 17.5 N., 75 W., S.E. f. 5; ship near 20.7 N., 81.8 W., E. to E.N.E. f. 3, 29.71 (probably too low); center placed on map near 19.5 N., 82.5 W., but near 18 N., 80.5 W. was perhaps a somewhat better location. Aug. 7, Kingston, S.E. f. 4, 29.95; ship near 21 N., 84 W., S. f. 2, 29.65 (probably too low); center just W. of the ship. Aug. 8, Merida, N.E. f. 2, 30.05 (it could be in error); ship near 22 N., 87 W., E. f. 5, 29.94; center probably near 20.5 N., 88.5 W. (over Yucatan). Aug. 9, ship near 22 N., 89 W., E.S.E. f. 6, 29.96; Merida E.S.E. f. 4, 29.83; Tampico, N. f. 3, 29.78; Veracruz, S.W. f. 1, 29.71; center probably near 20.5 N., 92.5 W. Aug. 10, Tampico, S. f. 2, 29.73; Mexican station N.W. of Tampico, N. f. 5, 29.88; center probably near 23 N., 98.5 W. (Historical Weather Maps, Aug. 1909). 3) On Aug. 9 reports from Yucatan and the Mexican Gulf coast indicated the presence of a disturbance of marked intensity near or west of the northern point of Ycatan or in the Gulf of Campeche. By the following morning the center of the disturbance had apparently moved inland in the vicinity of Tampico after which it appeared to pass inland and dissipate in heavy rains in the mountain districts during Aug. 10-11 (Monthly Weather Review, Aug. 1909). Author's note: Taken from a monthly report prepared by E.B. Garriott.

On the basis of information in the above items, primarily in items 1) and 2), the author of this study introduced a number of modifications along the track for this storm in Neumann et al. (1993), which is the only one known to the author and which was started as early as Jul. 27. On the basis of information in items 1) and 2), the author decided to start his own track on Aug. 6 and the reason for the late start with respect to the above publication was that no definitive indication of a cyclonic circulation was found in the data in late July and early Aug. The author's 7 A.M. Aug. 6 position was estimated near 18.0 degrees N., 80.5 degrees W., although it should be admitted that he had a low confidence in that position. His 7 A.M. Aug. 7 position was estimated near 21.0 degrees N., 84.3 degrees W. on the basis of a nearby ship observation (item 1) and his confidence in that position is much higher than in the one for Aug. 6. Author's 7 A.M. positions for the period Aug. 8-10 were as follows: Aug. 8, near 20.5 degrees N., 88.5 degrees W.; Aug. 9, near 20.5 degrees N., 92.5 degrees W.; Aug. 10, near 23.0 degrees N., 98.5 degrees W. The difference between author's positions and the corresponding positions in Neumann et al. (1993) was found to range from 240 miles on Aug. 7 to about 130 miles on Aug. 9-10. The author's track for Storm 4, 1909 is shown in Fig. 1.

Since no wind of force 8 or higher was found to be associated with this weather system (items 1 and 2), the tropical storm status that Neumann et al. (1993) gave to it could not be rigorously checked. However, that status was accepted by the author of this study on the basis of the terminology "disturbance of marked intensity" used in item 3). In spite of that the system probably did not reach tropical storm intensity until Aug. 9, such intensity was denoted along the author's track over the period Aug. 6-10. The depression (dissipation) stage was introduced in the morning of Aug. 10, when the system was over N.E. Mexico.

Storm 5, 1909 (Aug. 20-28), H.

The following information was found about this storm: Aug. 20, Barbados, N.W. f. 2, 29.95; ship near 13 N., 54 W., S.E. f. 4, rain; ship near 11 N., 57 W., W. f. 4; ship near 11 N., 58 W., N.E. f. 5, 29.94 (probably wrong position or data); ship near 21 N., 60 W., E. f 4; center probably near 15.5 N., 56.5 W. Aug. 21, Barbados, W.S.W. f. 4, 29.91; ship near 12 N., 58 W., S. f. 6; ship near 11 N., 57 W., S.W. f. 4; Martinique, W.S.W. f. 2, 29.88; Dominica, calm, 29.86; ship near 19 N., 63 W., N.E. f. 5; center probably near 16.5 N., 60.5 W. Aug. 22, ship

(or station) near 18 N., 63 W., S.E. f. 9, 29.86; San Juan, N.E. f. 5, 29.72, heavy rain; center placed near 17.3 N., 65 W., (probably a bit far E.). Aug. 23, Turks Is., S.E. f. 5, 29.78; Santo Domingoo, S. f. 6, rain; ship (or station) near 20 N., 72.5 W., E.N.E. f. 7; ship near 17 N., 73 W., N.W. f. 6; Kingston, N.W. f. 2, 29.77; center appears to be near 18.3 N., 72 W., although it was a bit farther N. according to other sources which placed it over northern Haiti. Aug. 24, ship or station near 18 N.,77 W., S. f. 5; Kingston, E. f. 3, 29.79; Havana N.E. f. 3, 29.82; ship near 20 N., 84 W., N. f. 4; ship near 16 N., 83 W., W.N.W. f. 2, 29.91; center placed near 20 N., 79.5 W. Aug. 25, ship near 23.8 N., 85 W., E. f. 9; Havana, E.S.E. f. 3, 29.89; Merida, N. f. 4, 30.18 (wrong pressure); ship near 16.7 N., 87 W., W.S.W. f.6, rain; ship near 20 N., 79 W., S.E. f. 6; center near 20.5 N., 85.5 W. Aug. 26, Merida, S. f. 2, 29.90; ship near 24 N., 85 W., E. f. 8; Havana, E. f. 2, 30.00; ship near 20 N., 82 W., S. f. 6, 29.97; center placed 19.5 N., 91.5 W.; however, it is likely that in reality was near 22 N., 91 W. Aug. 27, Tampico, W. f. 5, pressure could not be read; ship near 24 N., 97 W., N.E. f. 12; center placed on map near 25 N., 94 W., but it should have been near 23.5 N., 96.7 W., just to the S.S.E. of the ship. Aug. 28, Tampico, S. f. 4, 29.84; ship near 24 N., 96 W., S.E. f. 12, 29.68; Brownsville, E.S.E. no speed, 29.76; center near 25 N., 98.7 W., probably a bit N. (Historical Weather Maps, Aug. 1909). Author's note: Wind forces (f) are on Beaufort scale and pressures are in inches. 2) A storm showed marked intensity during its passage over the Caribbean Sea and caused an enormous loss of life and property in northern sections of Mexico. This hurricane appeared E.N.E. of Barbados on Aug. 20 and advices were then issued that that it would probably move on a westerly course. By the morning of Aug. 21 the center advanced to the vicinity of Martinique from which position it moved westward and on the morning of Aug. 22 was central to the S. and apparently near Puerto Rico. On Aug. 23 there appeared to be two cyclonic centers moving on a N. of W. course, one over the Windward Passage and another, a secondary or "twin" storm south of Haiti. On Aug. 23 the storm caused great loss of property on the Mole St. Nicholas, Haiti, many houses being wrecked by high easterly gales and by waves that rolled in from the bay. During Aug 24 the southern provinces of Cuba were visited by heavy winds and rains that caused considerable property damage and in the afternoon a wind velocity of 60 mph from the N.E. was reported at Havana. On Aug. 25 the steamship "Cartago" was obliged to heave to 13 hours in the Yucatan Channel with wind blowing at an estimated velocity of 100 mph, beginning in the morning from the N.E. and shifting shortly after noon to the E. by S.E. and continuing from that quarter during the afternoon. The position of the "Cartago" in the Channel, 25 miles off the Yucatan coast, with hurricane winds and high seas that dashed over the ship, was one of extreme peril. Damage, however, was of a minor character. The morning of Aug. 26 the captain sent an account of the storm by wireless to Burwood, La. This was the first instance of a storm experience at sea that was transmitted in season to be utilized in forecast work. Following a W.N.W. course from the Yucatan Channel the hurricane center reached a position in the Gulf off and probably S.E. of the mouth of the Rio Grande River by the morning of Aug. 27 and then moved inland near the mouth of the Rio Grande, attended by excessive rains than caused an enormous loss of life and property by flood in northeastern districts of Mexico. Messages received from the Point Isabel Life-Saving Station on Brazos Island indicated the character of the storm at that point. A late message was as follows: "This vicinity struck by a violent hurricane. Keeper and crew compelled to abandon station. Stopped at Tarpon Beach, and rescued all people on surf boats and brought them over to Point Isabel Station in a dangerous condition. Keeper and crew still at Isabel. Heavy weather" (Monthly Weather Review, Aug. 1909). Author's note: Taken from a report prepared by E.B. Garriott. Other brief reports about the storm were published in Tannehill (1938) and Weather Bureau (1911). 3) Belen College Observatory, Aug. 21, 10:30 A.M. The new cyclonic perturbation is apparently located E. of Martinique; nothing is known so far about its intensity. This forecast was wired to Washington at 9 A.M. today. L. Gangoiti, S.J. (Diario de la Marina, Havana, Aug. 21, 1909, evening edition, p.4, col.1) 4) Belen College Observatory, Aug. 22, 1 P.M. The cyclonic perturbation will probably pass today over Puerto Rico from S.E. to N.W., with notable intensity. At 7 A.M. this morning its center was to the S.S.W. of St. Thomas, near Vieques Island as we have cabled to Washington and other places. L. Gangoiti, S.J. (Diario de la Marina, Havana, Aug. 23, 1909, morning edition, p.4, col.1). 5) Washington, Aug. 21.

Conditions continued threatening over the West Indies and a well defined disturbance is moving W. from the vicinity of Martinique (The New York Times, Aug. 22, 1909, p.17, col.7). Author's note: The above statement was probably issued in the night of Aug. 21. 6) Belen College Observatory, Aug. 23, 5 P.M. The center of the perturbation was near Baracoa at noon today as we have cabled to Washington; by 3 P.M. it had advanced to the W. of that town. We have received from Washington, with some delay, the following telegram: "Hurricane center near and S. of Haiti, moving to W. one quarter to N.W; it will be severe in Cuban waters and probably Jamaican ones during the next 24 hours". L. Gangoiti, S.J. (Diario de la Marina, Havana, Aug. 24, 1909, morning edition, p.5, cols. 4-5). 7) Guantanamo, Aug. 24, 8 P.M. During yesterday the atmosphere showed a cyclonic character, but the S. wind cleared the clouds; the thermometer (it should read barometer) rose some degrees (lines) after having shown "tempestad" or storm (Diario de la Marina, Havana, Aug. 25, 1909, morning edition, p.9, col.2). 8) Cienfuegos, Aug. 24. Last night and this morning the weather was cyclonic with gusty winds and rain at times. The remaining of the day the weather was the same but the rain ceased. Father Sarasola of the Monserrat College indicated that the cyclone was over the western portion of Camaguey. According to the last observations the cyclone is encountering some resistance and tends to shift southward (Diario de la Marina, Havana, Aug. 25, 1909, morning edition, p.9, col.5). 9) Belen College Observatory, Aug. 25. At 7 A.M. Aug. 23 our observations from Port-au-Prince, Jamaica, Guantanamo and Santiago de Cuba allowed one lo locate the center of the perturbation over northern Haiti; at noon had already reached the vicinity of Baracoa and during the afternoon and night advanced over the entire province of Santiago de Cuba, the vortex having moved back to sea near Santa Cruz del Sur. At 4 P.M. yesterday the vortex was between the meridians of Cienfuegos and Havana, passing to the S. and not far away. At 6 A.M. this morning the vortex was over the extreme western Cuba and the Yucatan Channel, passing to the Gulf (Diario de la Marina, Havana, Aug. 25, 1909, evening edition, p.4, col.1). 10) Camaguey, Aug. 24, 4 P.M. The mayor of Santa Cruz del Sur sent a telegram as follows: A strong tempest is affecting us since the early morning; there has been some improvement now at 2 P.M. (Diario de la Marina, Havana, Aug. 25, 1909, evening edition, p.4, col.2). 11) Caimanera, Aug.24, 11 A.M. Yesterday strong winds and intermittent showers were felt; by night wind and showers increased. It looked good at daybreak today (Diario de la Marina, Havana, Aug. 25, 1909, evening edition, p.4, col.2). 12) Batabano, Aug. 25, 2:20 P.M. Yesterday, variable weather with dropping barometer. Drizzle accompanied by N.E. gusts. Wind increased much by night, specially around 12:30 A.M. By daybreak today, heavy showers and gusty winds from the S. (Diario de la Marina, Havana, Aug. 26, 1909, morning edition, p.8, col.1). 13) Washington, Aug. 24. The disturbance in the West Indies was reported Tuesday afternoon (Aug. 24) to the S. of western Cuba and moving W.N.W. At Havana the wind reached a velocity of 60 mph (The New York Times, Aug. 25, 1909, p.14, col.7). 14) Washington, Aug. 25. The disturbance has entered the Gulf of Mexico by the Yucatan Channel and it is probably moving N.W. (The New York Times, Aug. 26, 1909, p.13, col.7). 15) Washington, Aug. 26. Storm warnings are displayed from Apalachicola to Port Isabel, Tex. A wireless message from the steamship "Cartago" reports that this vessel encountered a hurricane of great intensity in the Yucatan Channel Wednesday night, Aug. 25 (The New York Times, Aug. 27, 1909, p. 12, col.7). 16) The cyclone of Aug. 21-28 affected the Island of Hispaniola (Garcia-Bonnelly, 1928). 17) Aug. 23-25, 1909. Cyclone of medium intensity along all the island (of Cuba). It entered through the eastern extreme of the island, went back to the Caribbean (Sea) near Camaguey, and passed S. of Havana towards the Yucatan Channel. Considerable damage was done on both extremes of the island and a number of vessels were lost, among them the steamer "Nicolas" at Isle of Pines (Sarasola, 1928). Author's note: Actually taken from the catalog of Cuban cyclones by M. Gutierrez-Lanza, which is included in Sarasola (1928). 18) Bad weather at Las Villas province due to the cyclone of Haiti, which passed between Santa Cruz del Sur and Oriente province towards the end of Aug. 1909 (Martinez-Fortun, 1942). 19) Washington, Aug. 27. The storm in the Gulf of Mexico has passed W. to near the mouth of the Rio Grande, where it is likely to pass inland and decrease in intensity. Severe gales have blown over the West Gulf coast in the past 24 hours, with a maximum velocity of 68 mph at Corpus Christi (The New York Times, Aug. 28, 1909, p. 13. col.7). 20) Monterrey, Mexico, Aug. 28. 800 persons drowned, 15000 homeless and

property damage up to $ 2 million is the result of the flood that struck the city between 11 and 12 o'clock this morning (The New York Times, Aug. 29, 1909, p.1, col.1). 21) Maximum wind velocity was 56 mph at Corpus Christi on Aug. 27 (Monthly Weather Review, Aug. 1909). Author's note; This value is lower than the one of 68 mph mentioned in item 19). 22) Minimum pressure at Corpus Christi was 29.74, apparently without reduction to sea level (Weather Bureau, 1911). 23) Storm of Aug. 27-28, 1909. Lower Texas coast. Minimal. Major in Mexico, over 1500 killed (Dunn and Miller, 1960). 24) Map showing a track for the storm, displaying the following morning positions: Aug. 24, near 20.5 N., 79 W.,; Aug. 25, near 20.7 N., 85.3 W.; Aug. 26, near 23 N., 90 W.; Aug. 27, near 24.7 N., 95 W.; Aug. 28, near 25.3 N., 101 W. (Monthly Weather Review, Aug. 1909). 25) A storm was first observed near 16 N., 60 W. on Aug. 21, 1909 and lasted 6 days; it was last observed near 27 N., 99 W. (Mitchell, 1924). Author's note: Tracks for this storm in Tannehill (1938) and Neumann et al. (1993) have some similarities with the corresponding track in Mitchell (1924). However, the track in Neumann et al. (1993) was started on Aug. 20 instead of on Aug. 21.

On the basis of information contained in the above items, the author of this study introduced a number of modifications along the track for Storm 5, 1909 in Neumann et al (1993). Based on information in item 1), the author's 7 A.M. positions for the period Aug. 20-22 were as follows: Aug. 20, near 15.5 degrees N., 56.3 degrees W.; Aug. 21, near 16.3 degrees N., 60.5 degrees W.; Aug. 22, near 17.3 degrees N., 65.7 degrees W.; for these three days the difference between the author's positions and the corresponding ones in Neumann et al. (1993) was around 45 miles. The author's 7 A.M. Aug. 23 position was near 19.0 degrees N., 72.3 degrees W. and was based on information in items 1), 6, and 9); this position was about 120 miles to the N.N.W. of the corresponding one in Neumann et al. (1993). The author's 7 A.M. Aug. 24 position was based on information in items 1) and 9) and on space-time continuity and was estimated near 20.3 degrees N., 79.5 degrees W.; this position was about 30 miles to the N.W. of the one in the above publication. The author's 7 A.M. Aug. 25 position was estimated near 21.0 degrees N., 85.5 degrees W. on the basis of information in items 1), 2) and 9); this position was a few miles to the S. of the one in the above publication. Author's 7 A.M. positions for Aug. 26-28 were primarily based on information in item 1) and were estimated as follows: Aug. 26, near 22.0 degrees N., 91.0 degrees W.; Aug. 26, near 23.7 degrees N., 96.7 degrees W.; Aug. 28, near 23.7 degrees N., 98.7 degrees W.; Aug. 28, near 24.7 degrees N., 98.7 degrees W.; the difference between these positions and the corresponding ones in Neumann et al. (1993) was found to range from about 140 miles on Aug. 27 to about 80 miles on Aug. 28. The author's track for Storm 5, 1909 is shown in Fig. 1.

The hurricane status which Neumann et al. (1993) gave to this storm was rigorously supported by ship observations showing winds of force 12 on the Beaufort scale on Aug. 27-28 (item 1) and by the wind estimate of 100 mph reported by the steamship "Cartago" when she encountered the storm in the Yucatan Channel on Aug. 25 (item 2). In accordance with item 23), the storm was a major hurricane in Mexico. Hurricane intensity was denoted along the author's track from late morning of Aug. 20 until the storm was well inland in northeastern Mexico in the morning of Aug. 28. In spite of having crossed over Hispaniola and Cuba, the author decided to keep hurricane intensity while the storm moved over both landmasses because of the considerable damage reported from Mole St. Nicholas, Haiti (item 2) and the words "cyclone of medium intensity" which were used to refer to the storm over Cuba and near that island (item 17). Tropical storm intensity was briefly shown along the author's track during the early part of Aug. 20 and in the afternoon of Aug. 28. The depression (dissipation) stage was introduced late on Aug. 28.

Storm 6, 1909 (Aug. 28-31), T. S.

The following information was found in relation to this storm: 1) Data extracted from 8 A.M. Historical Weather Maps: Aug. 27, Turks Is., calm, 29.96; ship near 26 N., 74 W., N.N.E. f. 2, 29.94; a closed cyclonic circulation may or may not have existed. Aug. 28, Jupiter, N.E. f. 5, 29.91; ship near 23 N., 73.7 W., S. f. 3; center placed 26.5 N., 76 W. Aug. 29, Jupiter, S.E. f. 4, 29.86; Tampa, N.E. f. 3. 29.93; Jacksonville, N. f. 3, 30.00. Aug. 30, Jupiter, W.S.W. f. 4,

29.94; Tampa, N.E. f. 2, 29.89; Jacksonville, E.N.E. f. 2, 29.95; weak low near Tampa, incorporated to a front as drawn on the map; however, no temperature contrast was noted. Aug. 31, low placed near 31 N., 79 W.; the low was shown as a frontal one, but no temperature below middle 70's was found around the low (Historical Weather Maps, Aug. 1909). 2) From Aug. 27 to Aug. 30 a shallow barometric depression advanced from the Caribbean Sea S. of Haiti northwestward to the Florida Peninsula and at the close of the month was central off the N.E. Florida coast (Monthly Weather Review, Aug. 1909). 3) Belen College Observatory, Aug. 28, 10:30 A.M. The cirrus convergence and direction indicated this morning the existence of a perturbation to the E.N.E. and far from Havana, towards the Bahamas. We have just received the following message from Washington: "Advisory at 10 A.M. For Miami and Jupiter, strong N.E. winds; perturbation center apparently S.E. of Andros Island, moving N.W. Moore". L. Gangoiti, S.J. (Diario de la Marina, Havana, Aug. 28, 1909, evening edition, p.4, col.1). 4) The maximum wind velocity at Savannah was N.E. 40 mph on Aug. 31 (Monthly Weather Review, Aug. 1909). 5) Map showing a track for this weather system starting near 23 N., 76.5 W. in the morning of Aug. 28, reaching a position near 28.5 N., 84.5 W. by the evening of Aug. 30 and ending off the coast between Savannah and Charleston in the evening of Aug. 31 (Monthly Weather Review, Aug. 1909). Author's note: The minimum pressure written down along the track was 29.82 inches. 6) A storm was first observed near 20 N., 67 W. on Aug. 27, 1909 and lasted 4 days; it recurved near 29 N., 82 W. and it was last observed near 29 N., 82 W. (Mitchell, 1924). Author's note: Tracks for this weather system in Tannehill (1938) and Neumann et al. (1993) were found to be similar to the one shown in Mitchell (1924).

On the basis of information in the items above, particularly in item 1), the author of this study introduced some modifications along the track shown in Neumann et al. (1993). The author's track was started on Aug. 28 instead of on Aug. 27 because of the uncertainty about the existence of a closed circulation on the last day mentioned (item 1). Author's 7 A.M. positions were estimated as follow: Aug. 28, near 26.5 degrees N., 76.0 degrees W; Aug. 29, near 26.5 degrees N., 80.5 degrees W.; Aug. 30, near 27.5 degrees N., 81.7 degrees W.; Aug. 31, near 31.0 degrees N., 79.0 degrees W. The difference between these positions and the corresponding ones in Neumann et al. (1993) was found to range from about 160 miles on Aug. 29 to about 90 miles on Aug. 30. The author's track for Storm 6, 1909 is shown in Fig. 1.

Because the only support for tropical storm intensity was the maximum wind velocity of N.E. 40 mph reported to have occurred at Savannah on Aug. 31 (item 4), the minimum pressure estimated along the track was 29.82 inches (item 5 and corresponding author's note) and the words "shallow barometric depression" were used to describe the alleged storm (item 2), the author of this study is somewhat skeptical about the merit of considering this weather disturbance as a tropical storm. Nevertheless, he decided to accept that classification as given by Neumann et al. (1993) and, therefore, tropical storm status was denoted along his track over the period Aug. 28-31. The depression (dissipation) stage was introduced late in the morning of Aug. 31.

Storm 7, 1909 (Sept. 14-21), H.

The following information was found about this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: No closed cyclonic circulation was found before Sept. 14. Sept. 14, Kingston, S.S.E. f. 1, 29.87; ship near 18 N., 74 W., S. f. 5, 29.86; ship off the eastern tip of Cuba, S.E. f. 5, 29.86, rain; ship near 22 N., 76 W., E. to E.N.E. f. 5, 29.97; possibility of a center between Jamaica and eastern Cuba, based on wind directions reported by ships and the very light wind at Kingston. Sept. 15, Kingston, E.S.E. f. 5, 29.85; ship near 16 N., 76 W., E.S.E. f. 5, 29.86; ship near 11 N., 81 W., N.W. f. 2; circulation center inferred near 14 N., 78 W., but indications from other sources were that the storm was much farther N., near Grand Cayman. Sept. 16, Havana, E. f. 4, 29.86; ship near 19 N., 79 W., S. f. 7, rain; Kingston, S.E. f. 3, 29.84; ship near 15.2 N., 76.8 W., S.S.E. f. 2; ship near 12 N. 78 W., S.S.E. f. 2, 29.86; center placed 18.5 N., 81.3 W. (too far S. and probably a bit E.). Sept. 17, Havana, E. f. 6, 29.74; ship near 21 N., 80 W., S. f. 7, 27.74; center placed 20.5 N., 80.5 W. (too far S. and E.). Sept. 18, Havana, E.S.E. f. 4, 29.82; Cuban station near 22.3 N., 83.8 W

(Pinar del Rio), E.S.E. f. 9, pressure could not be read; ship near 24 N., 85 W., E.N.E. f. 7, 29.47; ship near 19.8 N., 80 W., S.W. f. 4, 29.80; ship near 21.8 N., 87 W., N. f. 8; center placed 22.3 N., 85 W. (obviously too far S.). Sept. 19, ship near 26 N., 88 W., E. f. 8, 29.74; ship near 24 N., 85 W., S.E. f. 7, 29.68; ship near 22 N., 88 W., S.W. f. 4,; center placed 23.5 N., 87.3 W., too far S. and a bit E., near 25 N., 88 W. appears to be better. Sept. 20, ship or station on the southern coast of the Mississippi Delta, E.N.E. to N.E. f. 9, pressure could not be read; ship near 27.7 N., 91.7 W., W. f. 11; center placed N.N.E. of the ship, but that position appears to be too far W. when taking into account the second ship (or station) and information from other sources; a position near 28.3 N., 90 W. appears to be better. Sept. 21, center of the low near the place where borders of La., Ak. and Mi. meet (Historical Weather Maps, Sept. 1909). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches. 2) National Observatory, Sept. 14, 4 P.M. A cablegram from the Weather Bureau of Washington at 2:40 P.M. announces that there is a perturbation between Jamaica and eastern Cuba, which is apparently moving to the W. one quarter to N.W. Its diameter is small and it is of marked intensity (Diario de la Marina, Havana, Sept. 15, 1909, morning edition, p.3, col.6). Author's note: The same newspaper published a bulletin from the Belen College Observatory at 5:30 P.M. Sept. 14, referring to this system as a secondary cyclone, generally of a short radius and unknown intensity. 3) Belen College Observatory, Sept. 15, 8 A.M. At 7:30 P.M. last night we sent a cablegram to the Central Observatory of Mexico indicating that there was a perturbation to the E. of Grand Cayman and at 7:30 A.M. this morning we sent them another cablegram saying that it was near Grand Cayman. The storm remains at a good distance from us and its vortex will pass to the Gulf of Mexico, from today to tomorrow, where it could gain in organization (Diario de la Marina, Havana, Sept. 15, 1909, evening edition, p.4, col.1). 4) National Observatory, Sept. 15, 11 A.M. The perturbation is moving towards the S. of Isle of Pines, heading for the Yucatan Peninsula. It gave abundant rains over Oriente (province); there is no danger for the Republic (Diario de la Marina, Havana, Sept. 15, 1909, evening edition, p.4, col.1). 5) Washington, Sept. 16. A tropical storm is apparently moving toward the western Cuban coast or Yucatan Channel (The New York Times, Sept. 17, 1909, p.13, col.7). 6) From Belen College Observatory. The following communication from Father Gangoiti was received at the Presidential Palace yesterday: Sept. 17. Mr. Jose M. Gomez. Honorable President. At 1 P.M. yesterday Sept. 16 we sent this cablegram: Dr. Gomis- Pinar del Rio: Storm center will cross over western provinces. Be on the alert. The sane cablegram was also sent to Dr. Camejo at Remates de Guane. We have sent this morning (Sept. 17) special telegrams to the Meteorological Service of Mexico and the Weather Bureau, saying that the cyclone was entering Pinar del Rio (province). At 10 A.M. this morning (Sept. 17) we published that the vortex would pass to the Gulf of Mexico over or near the capital city of Pinar del Rio. Under these circumstances we were not surprised by the news you communicated to us. The weather continues improving at this time, 6 P.M., as we have announced to the press this morning; the cyclone is moving away from us. L. Gangoiti, S.J. (Diario de la Marina, Havana, Sept. 18, 1909, evening edition, p.4, col.1). 7) National Observatory, Sept. 18, 10 A.M. According to data received from the observers at Pinar del Rio and Herradura, the center of the tempest passed to the S. of that city (Pinar del Rio) before noon yesterday, causing torrential rains which have overflowed the rivers in the western portion (of Cuba). Because of this reason and the violent winds serious damage has occurred, without knowing details as yet. The tempest is to the W.N.W. of this capital (Havana), and also to the N. of the Yucatan peninsula, at the present time (Diario de la Marina, Havana, Sept. 18, 1909, evening edition, p.4, col.1). 8) Washington, Sept. 17. The tropical hurricane is now centered over western Cuba, apparently moving N.W. Gales and heavy seas are already reported from Sand Key and western Cuba. Hurricane warnings are displayed at Key West, Jupiter and Tampa (The New York Tines, Sept. 18, 1909, p.14, col.7). 9) Extracted from a communication sent to the Civil Governor by the Mayor of Nueva Gerona, Isle of Pines, on Sept. 17. The new cyclone which began affecting us since yesterday afternoon (Sept. 16) with more violence than the one of last Aug., became stronger in the early morning hours (Sept. 17) and caused great damage to buildings and the loss of orange crops. The steamer "James C. Cambell" and some small vessels came ashore but they have been refloated (Diario de la Marina, Havana, Sept. 20, 1909, evening edition, p.4, col.2). 10) The steamboat "Gussie", from

Mobile to Port of Spain was taken by surprise by the bad weather of Sept. 17 between Cape Frances and Isle of Pines at about midnight (Sept. 16-17). She was fighting the storm from 28 hours (Diario de la Marina, Havana, Oct. 6, 1909, evening edition, p.1, col.1). 11) National Observatory, Sept. 18, 4 P.M. The following message was received at the observatory last night: "Pinar del Rio, 6:10 P.M. An urgent telegram was received stating that the cyclone would pass over this city tonight. Although I understand that the vortex passed between 10 and 11 A.M. this morning, with a barometer drop to 741 millimeters (29.17 inches), I am in doubt and, please, let me know about this matter. Alfredo Portas, Mayor". As our observations and those sent to us by the Dept. of Agriculture showed that the storm center had passed S. of Pinar del Rio before midday, we replied to the mayor accordingly (Diario de la Marina, Havana, Sept. 19, 1909, morning edition, p.4, col.4). 12) The barometer began to fall over the Lesser Antilles Sept. 10 and from Sept. 12 to Sept. 14 a depression of apparently slight intensity moved westward over the Caribbean Sea. On the morning of the latter date two centers of cyclonic action appeared, one N. and the other S. of Jamaica. By the following morning the northern depression had apparently dissipated and the one to the southward of Jamaica had increased in intensity and was moving N.W. toward the Yucatan Channel where it arrived the morning of Sept. 17. At that time the barometer at Pinar del Rio, Cuba, read 29.44 inches, the wind had attained a velocity of 60 mph from the N.E. and a 24-hr rainfall of 7.88 inches was reported. Reports indicate that the storm damage at Pinar del Rio Province aggregated about $ 1 million (Monthly Weather Review, Sept. 1909). Author's note: The above information was taken from a report written by E.B. Garde. The statement indicating that the northernmost center observed on Sept. 14 to the north of Jamaica had dissipated by the next day, and that the center to the S. of that island intensified and moved N.W. appeared to be in error. On the basis of information in items 2) through 4), intensification of the northernmost center was apparently the one which occurred in reality, following the pattern most frequently observed in the development of tropical cyclones. 13) Taken from a communication written by the Mayor of Manta on Sept. 19: From 3 A.M. Sept. 17 until today's early morning, a strong cyclone, as previously announced, has struck here. Its effects were felt more intensively from 9 A.M. to 3 P.M. Friday (Sept. 17), followed by a calm for 4 hours, and beginning again at 7 P.M. and lasting until 1 A.M. (Sept. 18). Then, heavy rain continued Saturday and Saturday night (Sept. 18) until this morning (Diario de la Marina, Havana, Sept. 21, 1909, evening edition, p.4, col.2). Author's note: Manta is a town located in the western portion of Pinar del Rio province. 14) La Esperanza, Sept. 20, 3 P.M. I arrived (here) from Dimas. Vortex of the cyclone of Sept. 17 passed over us, preventing any forward motion (of the vessel) and, in spite of using three anchors, we drifted 3 miles. The sea swept over the deck, being impossible to remain on it at 4 P.M. Barometer read 750 millimeters (29.53 inches) at 10 A.M. and dropped to 732 millimeters (28.82 inches) at 4 P.M., a drop of 3 millimeters per hour, a larger hourly drop but identical depression than in the cyclone of Sept. 4, 1888. The vessel suffered much, and the engine became useless; I reached Dimas under great difficulties. I met the "Cespedes" there. Commander of the "Cespedes" and myself decided to tow the vessel to Esperanza. Lt. Rivera, Commander "Alacran" (Diario de la Marina, Havana, Sept. 21, 1909, evening edition, p.4, col.2). Author's note: La Esperanza and Dimas are located on the northwestern coast of Pinar del Rio province. The exact location where the "Alacran" met the storm was not given but it should have been not very far from Dimas. The above message from Lt. Rivera of the "Alacran" was received at the Cuban Dept. of Treasury. 15) Sept. 16-17, 1909. Intense hurricane crossed over Pinar del Rio (province) near its capital (City of Pinar del Rio). Enormous damage to towns and the country side (Sarasola, 1928). Author's note: Actually taken from the catalog of Cuban cyclones by M. Gutierrez-Lanza which is included in Sarasola (1928). 16) Cyclonic weather at Las Villas (central Cuba) due to the intense hurricane of Sept. 16-17, 1909 at Pinar del Rio (Martinez-Fortun, 1942). 17) Washington, Sept. 18. Rains have occurred in the S.E. States in connection with the tropical storm now central in the middle Gulf, moving N.W. (The New York Times, Sept. 19, 109, p.19, col.7). 18) Washington, Sept. 19. The tropical storm has continued its movement N.W. and is now apparently centered in the Gulf, S. of the Louisiana coast. A wind velocity of 40 mph was reported from Burwood and strong sea swells on either side at Pensacola and Galveston. Hurricane warnings are displayed along the Louisiana coast and storm warnings at other stations in the middle Gulf region (The New

York Times, Sept. 20, 1909, p.15, col.7). 19) Extracted from a special report on the hurricane of Sept. 20-21, 1909 on the Louisiana and Mississippi coasts: The center of the hurricane moved inland between the mouths of the Mississippi and the Atchafalaya rivers. The wind at Morgan City backed from the N.W., by the W., to the S. while at New Orleans it veered from the N.E., by the E., to the S.. The center of the disturbance moved northward over eastern Louisiana, passing about halfway between New Orleans and Morgan City. Excessive high tides occurred in the eastern section of the hurricane, flooding all the lowlands on the middle Gulf coast to a depth ranging from 2 to 10 feet. The highest storm tide occurred between the mouth of the Mississippi River and the Mississippi Sound. The occurrence of the highest tide in this part of the storm and so far from the center was, no doubt, due to the fact that the storm was moving N.W. until it reached the Louisiana coast and then curved more to the northward. Reports from Grand Isle, which was near the center of the storm, indicate a tide about 4 feet in that section as the highest water on the island was but 2 ft. From the Atchafalaya River westward, the northerly winds held the tide down; however, the winds were high and dangerous as far west as Galveston, Tx. (Monthly Weather Review, Sept. 1909). 20) Selected observations taken at New Orleans: Oct. 20, 1 A.M., 29.78, N.E. 22; 4 A.M., 29.73, N.E. 26; 7 A.M., 29.68, N.E. 26; 10 A.M., 29.63, N.E. 29; 1 P.M., 29.42, E. 25; 4 P.M., 29.31, E. 29; 5 P.M., 29.27, E. 45; 6 P.M., 29.24, S.E. 49; 7 P.M. 29.23, S.E. 55; 8 P.M. 29.26, S.E. 47; 9 P.M., 29.31, S.E. 42; 10 P.M., 29.34, S.E. 41; Sept. 21, 1 A.M., 29.48, S. 25; 4 A.M., 29.62, S. 14; 7 A.M., 29.71, S. 11; 10 A.M., 29.79, S. 10 (Cline, 1926). Author's note: Times are 90 degrees W meridian; pressures are in inches and wind speeds are in mph. 21) The wind at New Orleans reached an extreme velocity of 68 mph, minimum pressure of 29.22 inches. Property damage in Louisiana and Mississippi was estimated at $ 5 millions. Three hundred and fifty lives were lost (Tannehill, 1938). 22) Table showing an estimated central pressure of 931 millibars (about 27.50 inches) at landfall on the Louisiana coast (Simpson and Riehl, 1981). Author's note: The table was taken from Hurricane Experience Levels of Coastal County Populations- Texas to Maine, NWS Southern Region Tech. Rept. 12, 1975 by P.J. Hebert and G. Taylor. 23) Some maximum velocities associated with the storm were: Pensacola, S.E. 64 mph on Sept. 20; Mobile, S.E. 47 mph on Sept. 21; New Orleans, S.E. 66 mph on Sept. 20; Galveston, N.W. 34 mph on Sept. 20) (Monthly Weather Review, Sept. 1909). Author's note: The Monthly Weather Review, Sept. 1909 also published that the maximum velocity of 66 mph occurred at New Orleans between 6 and 7 P.M. 24) Storm of Sept. 20-21, 1909. Louisiana. Extreme. Tide: 15 feet, 350 killed (Dunn and Miller, 1960). 25) Map showing a track for the storm, starting near 19.5 N., 82 W. in the morning of Sept. 16 and ending over the eastern portion of Lake Superior in the morning of Sept. 22 (Monthly Weather Review, Sept. 1909). Author's note: As the Monthly Weather Review, Sept. 1909 stated that by 8 P.M. Sept. 21 the storm had merged with a barometric depression that had moved eastward over the Plain States and that by the morning of Sept. 22 a trough of low barometer extended from Lake Superior to the Rio Grande Valley, the Sept. 22 morning position was not representative of the tropical system itself. 26) A storm was observed near 15 N., 62 W. on Sept. 10, 1909 and lasted 14 days; it recurved near 35 N., 92 W. and it was last observed near 58 N., 67 W. (Mitchell, 1924). Author's note: Tracks for this storm in Tannehill (1938) and Neumann et al. (1993) were found to be similar to portions of the corresponding track in Mitchell (1924).

On the basis of information in the above items, the author of this study introduced a number of modifications along the track for Storm 7, 1909 in Neumann et al. (1993). As no closed cyclonic circulation was found before Sept. 14 (item 1), the author's track was not started until that day and, by so doing, a significant difference was established with respect to the track in the above publication which began on Sept. 10. The author's 7 A.M. Sept. 14 position was estimated near 19.0 degrees N, 77.0 degrees W. and was based on information in items 1) through 3); this position was about 330 miles to the N.W. of the corresponding one in Neumann et al. (1993). The author's 7 A.M. Sept. 15 position was primarily based on information in items 3) and 4) and space-time continuity and was estimated near 19.3 degrees N., 80.0 degrees W.; this position was about 300 miles to the N.W. of the corresponding one in the above publication. The author's 7 A.M. Sept. 16 position was estimated near 20.3 degrees N., 82.0 degrees W., primarily on the basis of information in item 1); this position was about 130 miles to the N.W. of the one in the

above publication. The author's 7 A.M. Sept. 17 position was based on a detailed analysis of information in item 1) and items 6) through 14) and was estimated near 21.7 degrees N., 83.7 degrees W.; this position was found to be a few miles to the N.W. of the corresponding one in Neumann et al. (1993). Author's 7 A.M. positions for Sept. 18 and Sept. 19 were primarily based on information in item 1) and were estimated near 23.0 degrees N., 85.3 degrees W. and near 25.0 degrees N., 88.0 degrees W., respectively, and were found to differ from the positions in the above publication by just a few miles on Sept. 18 and by about 35 miles on Sept. 19. The author's 7 A.M. Sept. 20 position was estimated near 28.3 degrees N., 90.0 degrees W. on the basis of information in items 1), 19) and 20) and space-time continuity; this position was a few miles to the W.S.W. of the corresponding one in Neumann et al. (1993). The author's 7 A.M. Sept. 21 position was estimated near 33.0 degrees N., 91.5 degrees W.on the basis of information in item 1); this position was about 70 miles to the S.S.E. of the corresponding one in the above publication; the author's track was terminated on Sept. 21 in accordance with information in item 25) and its corresponding author's note. The author's track for Storm 7, 1909 is displayed in Fig. 1.

Information in several of the 26 items above was found to support the hurricane status which Neumann et al. (1993) gave to this storm and, in fact, based on information in items 22) and 24), Storm 7, 1909 was a major hurricane. The hurricane status was introduced along the author's track on Sept. 16 and was kept until the evening of Sept. 20. Tropical storm intensity was denoted on Sept. 14-15 as well as late on Sept. 20 and early on Sept. 21. The depression (dissipation) stage was introduced on Sept. 21.

Storm 8, 1909 (Sept. 25-28), T. S.

The following information was found in relation to this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Sept. 22, low placed 17.5 N., 78.5 W. on spite of no indication for it because flow was N.E. to E. according to data. Sept. 23, ship near 19 N., 82 W., W. f. 2; Kingston, E. f. 1, 29.81; low placed 16 N., 79.5 W., confidence very low due to light winds. Sept. 24, ship near 20 N., 82 W., N.E. f. 1; ship near 19 N., 83 W., N.W. f. 2; Jupiter, N. f. 1, 29.80 (lowest barometer in the area covered by the system); rather a large broad area of low pressure, very weak E. flow over Florida Straits and western Cuba, with no decent wind anywhere. Sept. 25, Tampa, N.E. f. 4, 29.80; Key West, S. f. 2, 29.76; Jupiter, S. f. 2, 29.80; Havana, S. f. 2, 29.79; ship (or station) near 24.7 N., 83.2 W., S. f. 3, 29.77; low placed 26 N., 84 W., maybe too far W. Sept. 26, Jupiter, N.W. f. 2, 29.73; Key West, S.W. f. 3, 29.72; Tampa, N. f. 3, 29.81; Jacksonville, N.N.E. f. 3, 29.89; ship near 26 N., 77.7 W., S.W. f. 3; ship near 27 N., 72 W., N. f, 2, 29.86; ship near 30 N., 73 W., E. f. 6; ship near 27 N., 72 W., S. f.4, 29.80, showers. Sept. 27, Tampa, N. f. 4, 29.79; Jupiter, N.W. f. 1, 29.70; ship near 27 N., 78.5 W., N.W. f. 8, 29.86; ship near 30 N., 77 W., S.E. f. 7, 29.53. Sept. 28, ship near 32 N., 73.5 W., S.E. f. 4, 29.65; low placed 35 N., 70 W., too far N. and E.. Sept. 29, low no longer identified (Historical Weather Maps, Sept. 1909). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches. 2) Belen College Observatory (via telephone). The center of the cyclonic perturbation that was more than 38 hours ago S. of Jamaica is now over the N.E. portion of the Gulf of Hunduras and W.S.W. of Grand Cayman. This position could be threatening (Diario de la Marina, Havana, Sept. 24, 1909, evening edition, p.2, col.2). 3) Belen College Observatory, Sept. 26, 4 P.M. Yesterday morning the center of the perturbation was E. of Cozumel and S.W. of Isle of Pines. This morning it was located to the S. and near Cape San Antonio. L. Gangoiti, S.J. (Diario de la Marina, Havana, Sept. 27, 1909, evening edition, p.4, col.2). 4) National Observatory, Sept. 27, 10 A.M. From the observations within the area limited by New Orleans to the W., Jupiter to the N. and Santiago de Cuba to the E. it can be inferred that we are in an area of minimum pressure centered near this capital (Havana). This disturbance does not represent the danger of a cyclone to us, although showers are abundant along its periphery, with occasionally strong gusts (Diario de la Marina, Havana, Sept. 27. 1909, evening edition, p.4. col.2). 5) National Observatory, Sept. 28, 10 A.M. Observations. including those of clouds, from various places of the Republic confirm the center that has remained over the South Sea (Caribbean

Sea) lately. The center passed over the western portion of Santa Clara province last night, causing abundant rains and some heavy winds, although it is unlikely that they have caused damage at Jucaro, the capital (city of Santa Clara) and other places along the periphery of the low pressure area (Diario de la Marina, Havana, Sept. 28, 1909, evening edition p.2, col.2). 6) Map showing a track for this storm. The track was started between Havana and Key West in the morning of Sept. 25 and ended over Nova Scotia in the morning of Sept. 30 (Monthly Weather Review, Sept. 1909). 7) A storm was first observed near 11 N., 80 W. on Sept. 22, 1909 and lasted 11 days; it recurved near 22 N, 84 W. and it was last observed near 34 N., 64 W. (Mitchell, 1924). Author's note: Tracks for this storm in Tannehill (1938) and in Neumann et al. (1993) were found to be quite similar to the track in Mitchell (1924).

Information in items 1) through 4) show the very weak and extensive character of this weather system, particularly before Sept. 25. Therefore, the author's track was not started until that day when a 7 A.M. Sept. 25 position was estimated near 25.3 degrees N., 83 degrees W., showing that the author's track was begun 3 days later than the track in Neumann et al. (1993). Author's 7 A.M. positions for the period Sept. 26-28 were based on information in item 1) and were estimated as follows: Sept. 26, near 27.5 degrees N., 79.5 degrees W.; Sept. 27, near 29.5 degrees N., 77.0 degrees W.; Sept. 28, near 31.5 degrees N., 68.7 degrees W. The difference between the author's positions and the corresponding ones in Neumann et al. (1993) ranged from about 220 on Sept. 25 to about 100 miles on Sept. 27-28. Based on information in item 1), the author's track was terminated on Sept 28, which was 2 days earlier than in the above publication. The author's track for Storm 8, 1909 is shown in Fig. 1.

A ship report showing a N.W. f. 8 wind and a second ship showing a pressure as low as 29.53 inches (item 1) supported the tropical storm status that Neumann et al. (1993) gave to this weather system. Tropical storm status was denoted along the author's track for the entire period Sept. 25-28, although, in reality, tropical storm intensity is likely to have occurred only on Sept. 27-28. The depression (dissipation) stage was introduced late in the morning of Sept. 28.

Storm 9, 1909 (Oct. 6-13), H.

The following information was found in relation to this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Oct. 6, Puerto Limon (or ship nearby), N.W. f. 3, 29.91; ship near 11 N., 76 W., E.N.E. f. 6, 29.86; Kingston, N, f. 2, 29.91; ship near 19 N., 81 E.N.E. f. 4, 30.03 (probably too high); center probably a short distance N. of the Colombian coast near 76 W. Oct. 7, ship near 14 N., 79 W., N. f. 4, 29.80, showers; Kingston, S.S.E. f. 2, 29.84. Oct. 8, ship near 17 N., 81 W., N.W. f. 5, 29.77, showers; Kingston, S.S.E. f. 3, 29.83; center placed 17 N., 79.5 W.. Oct. 9, Havana, E. f. 4, 29.91; ship near 19 N., 84 W., N. f. 6, 29.74, showers; ship near 21 N., 84 W., no wind, 29.86; ship near 13 N., 83 W., W. f. 3, 29.86; center of low 18.3 N., 82.5 W., maybe a bit S. Oct. 10, ship near 21 N., 83 W., S.S.E. f. 8, 29.77; ship near 17 N., 84 W., S.W. f. 2, 29.83; Havana, E. f. 2, 29.89; center placed 20 N., 85 W. Oct. 11, ship near 23 N., 85 W., N.N.W. f. 8, 29.71; ship near 23 N., 86 W., N. f. 4, 29.77; Key West S.E. f. 8, 29.42, rain; Havana, S.W. speed could not be read, 29.34; center placed 24 N., 83 W., maybe a bit N. Oct. 12, ship near 26.5 N., 79 W., N.N.W. f. 4, 29,83; ship near 25.7 N., 76 W., W.S.W. f. 11, 30.00 (too high); Jupiter, N.N.W. f. 4, 29.77; ship near 29.7 N., 79 W., N.W. f. 5; ship near 27.7 N., 72 W., S.S.E. f. 4; center placed 29.5 N., 75 W. Oct. 13, ship near 32 N., 65 W. or Bermuda, W. f. 6, 29.56; ship near 28.7 N., 70 W., N.W. f. 6, 29.80; center near Bermuda (too far S.); cold front 42 N., 65 W. to 33 N., 71 W. Oct. 14, center apparently absorbed in cold front (Historical Weather Maps, Oct. 1909). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches. 2) National Observatory, Oct. 7. The cyclonic perturbation to the S. of Camaguey appeared to have advanced to near Isle of Pines on a N.W. course. Warnings of storm from the N.E. were issued at various places in Florida according to a cablegram received from the Weather Bureau of Washington at 4 P.M. (Diario de la Marina, Havana, Oct. 8, 1909, morning edition, p.10, col.2). 3) National Observatory, Oct. 8, 10 A.M. The perturbation which using data from the observer at Camaguey, Dr. Florentino Romero, was announced to the S. of Camaguey on Oct. 5, has moved W. over the Caribbean Sea and is

now towards the S.W. of the capital (Havana) and appears to be getting better organized (Diario de la Marina, Havana, Oct. 8, 1909, evening edition, p.4, col.1). 4) Belen College Observatory, Oct. 9, 9 A.M. The center of the cyclonic perturbation was at 7 A.M. this morning to the N.W. of Grand Cayman and S.S.W. of Isle of Pines, and about 150 miles. It will probably cross western Cuba between today and all day tomorrow, as we cabled to Washington. We believe that its intensity is weak in spite of the abundant cirrus clouds that emerged from the storm in the morning hours. L. Gangoiti (Diario de la Marina, Havana, Oct. 9, 1909, evening edition, p.4, col.1). 5) National Observatory, Oct. 9, 7 P.M. Based on observations from Pinar del Rio, Batabano and the local ones (Havana), it is inferred that the perturbation that was to the S.W. of Havana yesterday has continued towards the fourth quadrant, heading to the Gulf of Mexico. A cablegram from the Weather Bureau of Washington said: "We advise that at 4 P.M. the center of the tropical perturbation was apparently near the Yucatan Channel moving N.W. and with weak intensity" (Diario de la Marina, Havana, Oct. 1909, morning edition, p.10, col.4). 6) National Observatory, Oct. 11, 5 P.M. The cyclone reached a position to the W.S.W. of Pinar del Rio yesterday (Oct. 10) as we notified the Dept. of Agriculture of that province by telegram. From that position the hurricane recurved to the N.E., increasing in intensity. The storm center passed about 50 miles N.W. of Havana around 6 A.M. today. A cablegram from the Weather Bureau of Washington located the center to the W. of Key West at 9:30 A.M., moving N. L. G. y Carbonell (Diario de la Marina, Oct. 12, 1909, morning edition, p.8, col.1). 7) Extracted from an article by M. Gutierrez-Lanza, S.J. of the Belen College Observatory, dated on Oct. 13, 1909: During Oct. 7-9, the cyclone evolved slowly to the W., N.W., N. and N.N.E., recurving S. of the extreme western Cuba; during Oct.10 it started moving fast, passing the vortex along the province of Pinar del Rio moving between N.E. and N.N.E. towards Key West and Florida. On Sunday evening, without communication with our observer in Remates (de Guane), Dr. Wenceslao Camejo and with observations that were not alarming received from Pinar del Rio, and guided by our own observations (at Havana), we gave to the press the following note: "The center of the perturbation is about to finish crossing over Pinar del Rio province. Its intensity has increased during the whole day and the cyclone is apparently entering the second branch of the parabola at the present time. This is why the vortex has been approaching to this city since yesterday..." (Diario de la Marina, Havana, Oct. 14, morning edition, p.8, cols. 1-2). 8) Sabalo, Oct. 11. After 24 hours of continuous rains, the wind began to increase about 5 P.M. (Oct. 10), and it blew so hard that the inhabitants were in panic for 12 hours (Diario de la Marina, Havana, Oct. 13, 1909, morning edition, p.8, cols. 3-5). Author's note: Sabalo is located near the S.W. coast of Pinar del Rio province. 9) The (Cuban gunboat) "Cespedes" took refuge at the harbor of Guadiana. The towns of La Fe and Cayuco were completely wrecked. The tide reached 20 feet; the barometer dropped to 724 millimeters or 28.50 inches (Diario de la Marina, Havana, Oct. 15, 1909, p.10, col.3). Author's note: Guadiana is a bay on the western coast of Pinar del Rio province, and La Fe and Cayuco are nearby towns. 10) Guane, Oct. 11. A horrible hurricane struck this town. The barometer dropped more than when the hurricane of Aug. 27, 1856. Considerable losses were caused. The storm lasted for 6 to 7 hours, roughly from 6 A.M. (Oct. 10) to midnight (Oct. 10-11). Incessant lightning was observed to the N. and S. Telegraph lines are down (Diario de la Marina, Havana, Oct. 14, 1909, evening edition, p.4, cols.1-2). 11) Pinar del Rio, Oct. 11, 9:30 A.M. Approximately at 3 last night (it should read "early this morning") the bad weather abated. Conditions were calm by daybreak. Tremendous damage has been done by the terrible storm (Diario de la Marina, Havana, Oct. 12, 1909, evening edition, p.4, col.4). 12) Puerto Esperanza, Oct. 11. After incessant rains for 4 days, the cyclone began about 9 P.M. last night, with a terrible wind; strong gusts made houses to collapse and destroyed everything on their way. This lasted to about midnight, when there was some calm, which allowed us to save two sailors which were embracing the mast of their sunk vessels. The rescue was barely completed when the wind returned so furiously that no house or tree was left without damage. The wind began to abate at 4 A.M. (Diario de la Marina, Havana, Oct. 14, 1909, evening edition, p.3, col.6). Author's note: Puerto Esperanza is located on the northwestern coast of Pinar del Rio province. 13) Artemisa, Oct. 11. The cyclone struck this municipality, doing much damage. The barometer dropped to 740 millimeters (29.13 inches) at 3 A.M. (Diario de la Marina, Havana, Oct. 13, 1909, morning

edition, p.8, col.4). 14) Mariel, Oct. 11. The cyclone began around 12:30 A.M.; S.E. wind veering to S. at 4 A.M. It changed to N.W. at 5:30 A.M., with less force (Diario de la Marina, Oct. 12, 1909, morning edition, p.8, col.1). 15) Guanajay, Oct. 11, 5 P.M. Some observations taken by Mr. Pedro Nunez Lostrado: Oct. 10, 10 P.M., 759 millimeters or 29.88 inches; 11:30 P.M., 754 millimeters or 29.69 inches. Oct. 11, 1 A.M., 748 millimeters pr 29.45 inches; 2:30 A.M., 743 millimeters or 29.25 inches; 3:30 A.M., 741 millimeters or 29.17 inches; 5 A.M., 740 millimeters or 29.13 inches (Diario de la Marina, Havana, Oct. 13, 1909, evening edition, p.4, col.4). 16) Taken from an article by M. Gutierrez-Lanza, S.J. of the Belen College Observatory, dated on Oct. 13, 1909: The hurricane reached its maximum intensity at Havana between 5 and 6:15 A.M. (Oct. 11). The barometer read 739.4 millimeters (29.11 inches) at 6:15 A.M. and the wind velocity of 60 meters per second (130 mph) was recorded at 5:30 A.M. (Diario de la Marina, Havana, Oct. 14, 1909, morning edition, p.8, col.1). 17) Map showing a track of the storm center over western Cuba. At 6 P.M. Oct. 10 the center was located just off the southwestern coast of Pinar del Rio, about midway between Cape Corrientes and Cape Frances. At midnight (Oct. 10-11) the center was placed on the northern coast of Pinar del Rio province, a short distance to the S.W. of Puerto Esperanza (Diario de la Marina, Havana, Oct. 18, 1909, morning edition, p.6, cols.3-5). 18) A second map showing a storm track over western Cuba. This second track showed the storm to have made landfall on the southern coast of Cuba near Cape Frances, or a short distance to the E. of the previous track. However, the center of the hurricane was shown to have emerged from the northern Cuban coast near Puerto Esperanza, which is about the same location shown by the previous track (Diario de la Marina, Havana, Oct. 19, 1909, evening edition, p.2, cols. 3-5). 19) Oct. 10-11, 1909. Destructive hurricane over the provinces of Pinar del Rio and Havana, reaching its effects to Matanzas and Santa Clara. Terrible damage, a great number of casualties and loss of vessels at Pinar del Rio and Havana (Sarasola, 1928). Author's note: Actually taken from the catalog of Cuban cyclones by M. Gutierrez-Lanza which is included in Sarasola (1928). 20) Cyclonic weather at Las Villas due to the cyclone of Oct. 11 (1909) at Pinar del Rio and Havana, which continued to Florida (Martinez-Fortun, 1942). 21) Attending the presence of the storm over the western Caribbean Sea on Oct. 9 a tidal wave swept from the Gulf of Mexico over low-lying islands and sea coasts along the Yucatan Peninsula, drowning, it is reported, a large number of fishermen and their families (Monthly Weather Review, Oct. 1909). 22) On Oct. 10 storm warnings were ordered on the southern Florida coast, and at 6 A.M. Oct. 11, storm warnings were changed to hurricane warnings at Sand Key and Key West, Fl. Following this action, Florida Weather Bureau stations were telegraphed as follows: Hurricane now central near Key West promises to be destructive to life and property over a large portion of the Florida Peninsula. You are authorized to incur any necessary expense and to adopt any reasonable measure to disseminate warnings to the islands, coast cities and even the interior of the State (Monthly Weather Review, Oct. 1909). 23) The following notes by Mr. Dague, Weather Bureau Observer, are
descriptive of the action of the storm at Sand Key: The office was abandoned at 8:30 A.M. (Oct. 11) and the barograph and supplies were carried to the lighthouse... At 9:15 A.M. the anemometer cups were blown away. At this time the wind was estimated at 100 mph with gusts that exceeded that velocity... At 10:30 A.M. the Weather Bureau building went over and was immediately washed out to sea... The barometer fell rapidly from 4 until 11:30 A.M. when the minimum reading, 28.37 inches, was registered. A rise then set in and continued until 6 P.M. at which time the weather had moderated (Monthly Weather Review, Oct. 1909). 24) Extracted from a report made by the Weather Bureau observer at Key West, Fl.: From 9 P.M. Oct. 10 to 6 A.M. Oct. 11, the barometer fell steadily to 29.52 inches From 6 A.M. to 11:40 A.M. Oct. 11, the barometer fell to 28.50 inches, the lowest reading ever recorded at this station. At 11:40 A.M. the wind shifted from the N.E. to the N.W. and in 30 minutes the barometer rose one-half inch. At 7 P.M. it had risen to 29.61 (inches). The wind increased from 2;30 to 8:50 A.M. and from the latter hour it continued at hurricane force until 1:05 A.M., with maximum velocity 83 mph from the N.E. between 10;05 and 10:10 A.M. and an extreme velocity at a rate of 94 mph at 10:07 A.M. From 4 to 11:45 A.M. 8.02 inches of rain fell and between 8:45 and 11 A.M. there was a downpour of 6.13 inches (Monthly Weather Review, Oct. 1909). Author's note: Hourly observations taken at

Key West during the storm passage are included in Cline (1926). These observations show that the wind velocity did not exceed 20 mph until 2 A.M. Oct. 11 and did not exceed the same speed after 3 P.M. The maximum velocity indicated in Cline (1926) was 74 mph at 11 A.M. Weather Bureau (1911) and Tannehill)1938) also described meteorological aspects of the storm in Florida. 25) The passengers and most of the crew of the steamship "Antilles" which went ashore a week ago on the Great Bahama Bank in the hurricane which devastated the southern coast arrived yesterday on the steamship "Comus". The "Antilles" sailed from New Orleans on Oct. 9. By Monday night (it should read Sunday night, Oct. 10) she had crossed the Gulf of Mexico and was rounding the end of Florida when at daybreak (Oct. 11) she ran into the first of a hurricane and that day she labored through a building rainstorm. By 11:30 A.M. the glass had dropped to 28.35 (inches) and the vessel was floundering in the head seas. At noon the vessel finally passed into the center of the storm area. For half an hour she ran through a rough sea but a dead calm. Then she plunged again into the midst of storm-tossed seas. As soon as the "Antillles" grounded, Branwell, the United wireless operator, began to send out a call for help (The New York Times, Oct. 19, 1909, p.4, col.4). Author's note: It is obvious that the "Antilles" went through the eye of the hurricane around noon Oct. 11, with barometer lower than 28.35 inches. 26) Key West, Oct. 11. Of 100 vessels in the harbor this morning, 5 remained at anchor; others having either gone to sea or washed upon the beaches. The storm reached its highest at 1 o'clock this afternoon when the wind had an estimated velocity of 100 mph. There was a hard, steady blow from 8 A.M. to 3 P.M. when the wind began to die down and by 4 P.M. the center had passed this point (The New York Times, Oct. 12, p.1, col.1). Author's note: The height of the storm occurred at Key West much earlier than 1 P.M. and the storm center passed near Key West around 11:40 A.M. Oct. 11 and not near 4 P.M. as indicated in the above item. 27) Key West, Oct. 14. The steamer "Pieroma" has arrived bringing the crew of the schooner "Florence R. Hewson". The schooner encountered the storm off Havana 25 miles. Her decks were swept clean and her rigging washed away. The crew managed to embark in sailboats, keeping afloat until being picked up by the "Pieroma" (The New York Times, Oct. 15, 1909, p.1, col.4). 28) Jupiter, Oct. 12. The hurricane did not extend N. of Miami. with any force. No damage is reported N. of this point and the lowest barometer here was 29.55 inches; the highest wind was 36 mph. The storm recurved S. of Miami and passed eastward at 50 miles of Nassau, but no damage was done in that city so far as can be learned (The Miami Metropolis, Oct. 12, 1909, p.1, col.7). Author's note: The Monthly Weather Review, Oct. 1909, stated that at Nassau, Bahamas, the storm was felt in the night of Oct 11 when the barometer fell to 29.37 inches and the wind reached a velocity of 50 mph from the S.W. 29) Oct. 14 is another day given in some meteorological lists as that of a hurricane striking Bermuda. Key West, Florida, experienced the full force of this hurricane on Oct. 12 (it should read Oct. 11), but the disturbance was merely felt in these islands (Bermuda) as strong winds on Oct. 13 (Tucker, 1982). 30) Table showing a minimum pressure of 957 millibars (28.26 inches) as the storm passed the Florida Keys (Simpson and Riehl, 1981). Author's note: The table was taken from Hurricane Experience Levels of Coastal County Populations- Texas to Maine. N.W.S. Southern Region Tech. Rept. 12, 1975 by P.J. Hebert and G. Taylor. 31) Maximum wind velocities associated with this storm were: N.E. 83 mph at Key West and E. 36 mph at Jupiter, both on Oct. 11 (Monthly Weather Review, Oct. 1909). 32) Storm of Oct. 11, 1909. Florida Keys. Major, 15 killed, damage $ 1 million (Dunn and Miller, 1909). 33) Map showing a track for this storm. The storm was placed S.W. of Isle of Pines in the morning of Oct. 10, just to the N.W. of Havana in the morning to Oct. 11, near 25 N., 80.5 W. in the evening of Oct. 11 and near 28 N., 77 W. in the morning of Oct. 12 (Monthly Weather Review, Oct. 1909). 34) A storm was first observed near 11 N., 80 W. on Oct. 6, 1909 and lasted 12 days; it recurved near 21 N., 83 W. and it was last observed near 53 N., 5 W. (Mitchell, 1924). Author's note: The track for this storm in Tannehill (1938) was very similar to a portion of the corresponding one in Mitchell (1924), which erroneously brought the storm to the southern coast of Havana province in the morning of Oct. 10 and then very slowly northward into the Florida Straits by the morning of Oct. 11. The track in Neumann et al. (1993) showed some differences with the two tracks just mentioned; it was some farther E. over the period Oct. 6-8 and by the morning of Oct. 10 showed the center to the S.W. of Isle of Pines and then moved it northward and northeastward over the eastern portion of Pinar del Rio province.

Based on information contained in the above items, the author of this study introduced some modifications along the track for Storm 9, 1909 which is shown in Neumann et al. (1993). Author's 7 A.M. positions for Oct. 6 and Oct. 7 were estimated near 10.7 degrees N., 76.0 degrees W. and near 13.7 degrees N., 77.7 degrees W., respectively, on the basis of information in item 1); these positions were about 120 miles to the S.E. and a few miles to the S.E. of the respective ones in the above publication. 7 A.M. positions for the period Oct. 8-9 in Neumann et al. (1993) were kept unchanged because they were found to satisfy information in item 1). The author's 7 A.M. positions for Oct. 10 and Oct. 11 resulted from a detailed study of information for those days contained in many of the 34 items above; his positions were estimated near 20.5 degrees N., 84.5 degrees W. and near 23.7 degrees N., 83.0 degrees W., respectively; the 7 A.M. Oct. 10 position was about 80 miles to the S.W. of the one in Neumann et al. (1993) and the 7 A.M. Oct. 11 position was about 70 miles to the W.S.W. of the corresponding one in the same publication. The author's 7 A.M. Oct. 12 position was estimated near 29.0 degrees N., 75.0 degrees W. on the basis of information in item 1); this position was about 120 miles to the N.E. of the corresponding one in Neumann et al. (1993). The author's 7 A.M. Oct. 13 position was estimated near 34.0 degrees N., 65.0 degrees W. on the basis of information in items 1) and 29); this position was found to be about 240 miles to the N.E. of the corresponding one in the above publication. The author's track for storm 9, 1909 is displayed in Fig. 1.

The hurricane status which Neumann et al. (1993) gave to this storm was found to be supported by information contained in many of the 34 items above. The lowest pressure of 28.37 inches reported at Sand Key (item 23), a pressure as low as 29.35 inches reported by the "Antilles" before entering the eye of the hurricane around noon Oct. 11 (item 25) and the estimated minimum pressure of 28.26 inches given in item 30) revealed that the storm was a major hurricane in the Florida Keys. The pressure reading of 28.50 inches and tides of 20 feet reported by the "Cespedes" to have occurred in the Bay of Guadiana area (item 9) and reported winds of 130 mph at Havana (item 16) indicated that the storm was also a major hurricane in western Cuba. Hurricane status was introduced along the author's track early on Oct. 9 and was maintained until around midday Oct. 12. Tropical storm status was shown for the track over the period Oct. 6-8, although it is almost certain that the system was a tropical depression in its formative state on Oct. 6. Tropical storm intensity was reinstated along the author's track in the afternoon of Oct. 12 and the depression (dissipation) stage was introduced late on Oct. 13.

Storm 10, 1909 (Nov. 8-14), T. S.

The following information was found in relation to this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Nov. 8. ship near 11 N., 82 W., E.N.E. f. 3, 29.68; two ships S. of Panama with S.W. wind f. 6. Nov. 9, ship near 17 N., 77 W., E. f. 3, 29.71 (too low); Kingston, N.W. f. 2; ship near 19 N., 76 W., E.N.E. f. 8, 30.00; ship off Inagua, E. f. 8, 30.03; Turks Is., N.E. f. 5, 30.09; low placed 13 N., 76.5 W.;which is too far E. Nov. 10, Turks Is., N.E. f. 5, 30.07; Kingston, N. f. 2, 29.89; ship near 18 N., 80 W., E.N.E. f. 6, 29.77; ship near 10 N., 80 W., W. f. 4, 29.50; ship near 12 N., 77 W., S.S.E. to S. f. 6, 29.74; low placed 14 N., 78.5 W., probably a bit N. and E., better near 13 N., 79 W. Nov. 11, Kingston, W. f. 3, 29.72; ship near 15 N., 77 W., E.N.E. f. 5, 29.68; ship near 14 N., 80 W., N.N.W. f. 6, 29.65; Turks Is., E.S.E. f. 5, 29.96; low placed 13.5 N., 78 W., probably a bit S. and W. Nov. 12, Kingston, N.N.W. f. 4, 29.70; ship near 18.8 N., 75 W., N. f. 5, 29.77; ship near 16 N., 74 W., N.W. f. 6, 29.74; Turks Is., N.E. f. 6, 29.76; ship near 16 N., 70 W., S. f. 7; San Juan, S.E. f. 3, 29.79; low placed 17.5 N., 70.5 W., too far E., the low was probably near the southern coast of Haiti, S.W. of Port-au-Prince. Nov. 13, Kingston, N.W. f. 2, 29.79; Turks Is., N.E. to N.N.E f. 5, 29.78; ship near 19 N., 68 W., S.W. f. 5, pressure could not be read; San Juan, S. f. 3, 29.69; ship near 25 N., 67 W., E. f. 9, rain; ship near 21 N., 66 W., N. f. 6, 29.71 (wind direction somewhat suspicious, it could have be N.E. or E.N.E. to fit better other observations); ship near 20 N., 64 W., S. f. 6; ship near 21 N., 63 W., S. f. 5, 29.83; low placed 20 N., 66.5 W., it could have been too far to the E. and located near 20 N., 67 W. in reality. Nov. 14, Kingston, N.N.E. f. 2, 29.89; ship near 19 N., 61 W., W. f. 5, 29.77, showers; ship near 22 N.,

59 W., E.N.E. f. 8, pressure could not be read but probably around 1005 millibars (29.68) according to isobar drawn; San Juan, N. f. 4, 29.87; Turks Is., N.E. f. 3, 30.02; Dominica, S.W. no speed, 29.88; ship near 15 N., 60 W., S.W. f. 4; Martinique, S. f.2, 29.89; low incorporated to a front and placed 25 N., 53 W., it seems to be very far to the N.E. and a position near 21 N., 59 W. appears to be more reasonable (Historical Weather Maps, Nov. 1909). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches. 2) During the latter half of the first decade of the month a storm that apparently acquired intensity in that neighborhood and remained nearly stationary for a period of 4 or 5 days caused exceptionally heavy rains in Jamaica. From Nov. 5 to 11, inclusive, the rainfall at Kingston was 30.45 inches. Six lives were lost, about 20 percent of the banana crop was destroyed. The lowest barometer reading at Kingston during the storm was 29.70 inches on Nov. 12. By the morning of Nov. 13 the storm center had advanced to a point near the west coast of Haiti, where great damage by flood was reported. Santo Domingo was also severely visited. Vessels in the path of the storm, both in the Windward Passage and on the Atlantic, experienced gales of exceptional violence (Monthly Weather Review, Nov. 1909). Author's note: The above information was extracted from an article by E.B. Garde. 3) Belen College Observatory, Nov. 11, 6 P.M. At the edge of the anticyclone we have enjoyed for many days a perturbation has formed and at 2 P.M. this afternoon was located to the S.E. of Santiago de Cuba, E. of Jamaica and W. of extreme western Haiti. We have sent this note to Washington. It would be best if it recurved soon to the N.E. as we expect. L. Gangoiti, S.J. (Diario de la Marina, Havana, Nov. 12, 1909, morning edition, p.4, col.3). 4) National Observatory, Nov. 11. According to observations from Camaguey this morning and from Santiago de Cuba at 3 P.M., it appears that there is a cyclonic perturbation to the S.E. of the latter province. This is confirmed by a cablegram from the direction of the Weather Bureau of Washington at 4 P.M. The cablegram says: "Indications of a perturbation over the central Caribbean Sea. Reports from Jamaica are missing" (Diario de la Marina, Havana, Nov. 12, 1909, morning edition, p.4, col.4). 5) Belen College Observatory, Nov. 12, 9 A.M. At 8 A.M. today we sent the following message to the Weather Bureau of Washington: "Center of the cyclone was W. of Gonave Island (Haiti) at 7 A.M. Its course appears to be N. one quarter to N.N.E." We have received from Mr. Moore at 9:20 A.M.: "Perturbation of marked intensity is apparently moving northward toward the Windward Passage." L. Gangoiti, S.J. (Diario de la Marina, Havana, Nov. 12, 1909, evening edition, p.4, col.1). Author's note: The National Observatory also published in the same issue the advisory sent by the Weather Bureau of Washington. 6) Belen College Observatory. The center of the cyclone was to the E.S.E. of Guantanamo at 3 P.M. (Nov. 12). At 8 P.M. (Nov. 12) we received the following cablegram from Mr. Ernesto Brook of Guantanamo: "Gangoiti-Havana. Following wireless message was from ship "Krompic", Kingston. Cyclone N.E. of Jamaica at 9 P.M. Thursday (Nov. 11). Unprecedented rainfalls on Wednesday and Thursday (Nov. 10-11). Great damage to railroads. Telegraph wires at down. 500,000 banana plants lost. American cruiser "Eagle" struck a pier; it was removed by the British cruiser "Seylla", sustaining great damage. Fruit steamers "Dorado", "Tratfort" and "Amanda" were wrecked. The "Amanda" was refloated. Brook." L. Gangoiti, S.J. (Diario de la Marina, Havana, Nov. 13, 1909, morning edition p.4, col.4). 7) Extracted from an article by L. Gangoiti, S.J. of the Belen College Observatory, dated on Nov. 30, 1909: A telegram from Port-au-Prince on Nov. 13 said that a violent hurricane has caused immense damage in the island of Haiti. Another cablegram from Cap Haitien on Nov. 13 said that the flooding due to the hurricane has cut communications with places where provisions are gotten, that the sea was very rough, that damage was considerable and that some fatalities occurred. A message from Holland Bay, Jamaica, stated that numerous plantations were totally destroyed. The Provincial Observatory of Santiago de Cuba said that the cyclone moderated about 6;30 P.M. (presumably of Nov. 12), at which time the barometer started to rise rapidly; at 6 P.M. the wind had blown very hard; coastal erosion and cyclonic winds were reported at Baracoa. From The New York Herald: Puerto Plata, Saturday (Nov. 13). Beginning with a light N. wind, a violent wind storm developed in a few hours, sweeping the sea into the port. Another wireless message said that at 8 P.M. Friday (Nov. 12, when passing Punta Maysi (extreme eastern Cuba) coming from Jamaica, the ship "August Wilheim" experienced strong winds and that the "Prince Joaquin" had to stop moving due to the heavy rain and hard winds. Telegram from Turks Is. on

Nov. 13: A strong storm was felt here on Friday (Nov. 12), accompanied by heavy rain and hurricane winds. From The New York Herald, Nov. 21: Narrative by the captain of the "Maracaibo". We left San Juan on Nov, 12 with rough seas but little wind. We were fully in the hurricane on Nov. 14 and for 8 hours we were in the eye of the storm. According to our estimate the wind blew 150 mph. Observations taken on board the "Boston", from Halifax to Turks Is., lat. 21 44 N., long. 71 1 W. Nov. 12, 5:30 P.M., wind E.N.E., rough sea, barometer 29.90 inches. Nov. 13, 4 A.M., E.N.E. hurricane wind, heavy seas and rain, barometer 29.86 inches. Nov. 13, midday, wind E.N.E. still strong, 29.79 inches; 4 P.M., barometer 29.70 inches, no change in weather conditions; 8 P.M., barometer 29.65 inches. Midnight Nov. 13-14, barometer 29.65 inches,--wind moderated; 4 A.M., barometer 29.65 inches, rain stopped, less N.N.E. wind, barometer 29.70 inches; 8 A.M., back on course towards Turks Is. On Nov. 11 the barometer was extremely high: 30.60 inches (Diario de la Marina, Havana, Dec. 2, 1909, morning edition, p.4, cols. 4-6 and p.5, cols.1-3). Author's note: The weather information furnished by the "Maracaibo" and the "Boston" appears to be unreliable. 8) Nov. 10-12, 1909. A somewhat intense cyclone passed through the Channel between Cuba and Haiti, and it was felt with moderate strength over eastern Cuba. Loss of the steamer "Maria Herrera" (Sarasola, 1928). Author's note: Actually taken from the catalog of Cuban cyclones by M. Gutierrez-Lanza which is included in Sarasola (1928). The storm center crossed over Hispaniola and did not pass through the Windward Passage. The "Maria Herrera" was a Cuban steamer which left Santiago de Cuba for Puerto Rico and was never heard from; the steamer is believed to have sunk in the storm. 9) Very bad weather at Oriente province and to a lesser extent at Camaguey and Las Villas due to the cyclone of Jamaica, Haiti and Turks Is., which caused the loss of the coastal steamer "Maria Herrera" (Martinez-Fortun, 1942). 10) Port-au-Prince, Nov. 13. The hurricane that crossed Haiti has caused immense damage, the extent of which it is as yet impossible to determine. There was considerable loss of life, according to reports from various places. At Gonaive, the river overflowed its banks and invaded the districts to the N. and S. of the town. The steamer "Alleghany", which arrived here, passed before Cap Haitien and Port de Paix but could not communicate with l;and on account of the heavy sea which was running (The New York Times, Nov. 14, 1909, p.2, col.5). 11) New York, Nov. 13. A telegram from Port-au-Prince, Haiti, stated that Haiti and Santo Domingo have been devastated by cyclones and heavy floods. Port de Paix, Gonaives, Cap Haitien and other towns are in ruin, and 19 dead have been already found in Port de Paix (The Times, London, Nov. 15, 1909, p.5, col.5). 12) Grand Turk, Bahamas, Nov. 13. A severe storm passed on this island yesterday. The wind was of hurricane force and was accompanied by heavy rain. No news have been received of the outlying islands for a week (The Times, London, Nov. 15, 1909, p.5, col.5). 13) The storm of Nov. 8-14, 1909 was felt on the island of Hispaniola, where it is known as that of San Severo (Garcia-Bonnelly, 1958). 14) A storm was first observed near 10 N., 81 W. on Nov. 8, 1909 and lasted 6 days; it was last observed near 20 N., 60 W. (Mitchell, 1924). Author's note: Tracks for this storm in Tannehill (1938) and Neumann et al. (1993) were found to be similar to the corresponding track in Mitchell (1924).

On the basis of information contained in the above items, particularly in item 1), the author of this study introduced some modifications along the track for Storm 10, 1909 shown in Neumann et al. (1993). Author's 7 A.M. positions for the period Nov. 8-14 were estimated as follows: Nov. 8, near 10.3 degrees N.,81.7 degrees W.; Nov. 9, near 11.3 degrees N., 80.3 degrees W.; Nov. 10, near 12.7 degrees N., 78.7 degrees W.; Nov. 11, near 14.3 degrees N.m 77.0 degrees W; Nov. 12, near 18.0 degrees N., 72.7 degrees W.; Nov. 13, near 20.0 degrees N., 67.7 degrees W.; Nov. 14, near 21.0 degrees N., 59.0 degrees W. The difference between the author's positions and the corresponding ones in the above publication was found to range from about 110 miles on Nov. 13 to about 60 miles on Nov. 8, Nov. 11-12 and Nov. 14. The author's track for Storm 10, 1909 is displayed in Fig. 1.

It was a difficult case for the author to decide whether or not to upgrade to a hurricane Storm 10, 1909 from the tropical storm intensity shown in Nuemann et al. (1993). On one hand, information in a number of the 14 items above suggested hurricane intensity both at Hispaniola and Turks Is. and the word "cyclone" used by the Belen College Observatory also implied hurricane status in accordance with Cuban nomenclature regarding tropical weather systems. On the other

hand, no winds of hurricane force and no pressures that were low enough to support them were reported in item 1), the word "Hurricane" is sometimes applied to strong rain storms (not to true hurricanes) in Santo Domingo and an analysis of the available information appeared to indicate that winds of near-hurricane or hurricane force were not concentrated near the storm center, but were blowing at considerable distances to the north. Under the above circumstances, the author decided to be conservative and to keep the tropical storm status given to the storm in Neumann et al. (1993). Tropical storm intensity was, therefore, denoted along the author's track over the period Nov. 8-13 and the extratropical stage was introduced on Nov. 14 in accordance with information in item 1).

Special statement.

In addition to the 10 storms which were discussed above, three possible cases were found in 1909. These three cases are presented next.

A) Case of Jun. 2-4, 1909.

The Monthly Weather Review, Jun. 1909, indicated that a shallow barometric depression formed in the western part of the Gulf of Mexico early in the month and showed a map indicating it had a central pressure of 29.66 inches when near the Delta of the Mississippi. Data plotted on the Historical Weather Maps allowed one to draw a weak low pressure center to the S.S.W of Galveston and to the E.N.E. of Corpus Christi in the morning of Jun. 2. By the morning of Jun. 3, the center had moved to the Mississippi coast, with New Orleans reporting a northerly wind which intensity could not be read off the map and a pressure that could not be clearly read but probably was about 29.65 inches. Pensacola reported a S.E. f. 6 wind and a pressure of 29.69 inches, and a ship just S. of the Mississippi Delta showed a S.W. f. 6 wind and a pressure of 29.65 inches. The low was drawn as an extratropical one but this could be questionable. By the morning of Jun. 4, the low was placed over eastern Tennessee and a temperature contrast around the low supported extratropical characteristics. Although no winds of tropical storm intensity (f. 8) were shown around the system on Jun. 3, the reported pressures were low enough to consider this case as a possible one.

B) Case of Jun. 15- 18, 1909.

This possible case was shown in Historical Weather Maps, Jun. 1909. The morning map for Jun. 15 showed a ship with a S. f. 8 wind near 11 N., 82 W. Another ship with S.E. f. 6 wind and pressure of 29.91 inches and rain appeared plotted on the Jun. 16 morning map. W. and S.W. winds f.2 were shown by two ships in the southwestern Caribbean Sea on the Jun. 17 morning map. The Jun. 18 map showed a ship reporting an E. f. 8 wind near 14 N., 82 W. Although winds of tropical storm intensity were drawn on the maps for Jun. 15 and Jun. 18, this case was kept as a possible one because those two observations could have been reported by the same vessel and be in error. In addition, pressures of only around 29.80 inches which were reported by ships in the area on Jun. 16-17 did not suggest tropical storm intensity.

C) Case of Oct. 16-24, 1909.

The Belen College Observatory first announced to the Weather Bureau of Washington some indications of a perturbation to the N.W. of Martinique in the morning of Oct. 16 and at 3 P.M. that day this was confirmed by the Weather Bureau which said that there was a depression over the Lesser Antilles, probably moving towards the west (Diario de la Marina, Havana, Oct. 17, 1909, morning edition, p.4, col.4). Advisories from the Belen College Observatory and the National Observatory placed the perturbation to the S. of Haiti and Jamaica in the morning of Oct. 19 (Diario de la Marina, Havana, Oct. 19, 1909, evening edition, p.4, col.1). By the morning of Oct. 20 the Belen College Observatory placed the perturbation to the N.E. of Cape Gracias a Dios

(Nicaragua) and over 300 miles to the S. of Havana (Diario de la Marina, Havana, Oct. 20, 1909, evening edition, p.4, col.1). According to advisories published in Diario de la Marina, Havana, Oct. 22, 1909, evening edition, p.4, col.2, the Belen College Observatory located the tempest to the S.S.W. of Havana at 7 P.M. Oct. 21, and about the same time the National Observatory announced that it was located some 250-300 miles to the S.W. of Havana. This observatory added that in the morning of Oct. 22 the barometer had remained high and making its diurnal oscillations, which indicated that the storm had not recurved. Examination of maps in Historical Weather Maps, Oct. 1909, showed a wave-like disturbance to have moved from the vicinity of the Lesser Antilles on Oct. 16 to the Yucatan peninsula by Oct. 22. Although a weak cyclonic circulation was drawn off Yucatan on the Oct. 21 map, data throughout the entire Oct. 16-22 period did not seem to support a closed circulation. The Monthly Weather Review, Oct. 1909, stated that from Oct. 22 to Oct. 24 a storm passed from the western Caribbean Sea to the lower portion of the Gulf of Mexico attended by excessive and persistent rains that caused destructive floods in the State of Tabasco. Curiously, the weather maps for Oct. 22-24 showed high pressure over Tabasco, protruding in the form of a ridge from the west. Based on the above information, the author believes that this case had only a small chance to have become a tropical storm; nevertheless, the decided to include it as a possible one.

A weak low was drawn over the western Gulf of Mexico on the morning weather maps for Jun. 20-21 (Historical Weather Maps, Jun. 1909), and tracks for two storms starting on Nov,. 22 and Nov. 25, 1909, respectively, were included in Mitchell (1924) and reproduced in Tannehill (1938) as his Storms 11 and 12, 1909. The author has examined the data available for the three cases in Historical Weather Maps, Jun. and Nov. 1909, and concluded that these cases practically did not have any chance to have reached tropical storm intensity. Therefore, they were not included as possible cases.